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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) 2199
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2199
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2201
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 2202
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2202
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2203
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2205
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2205
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2206
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2206
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2207
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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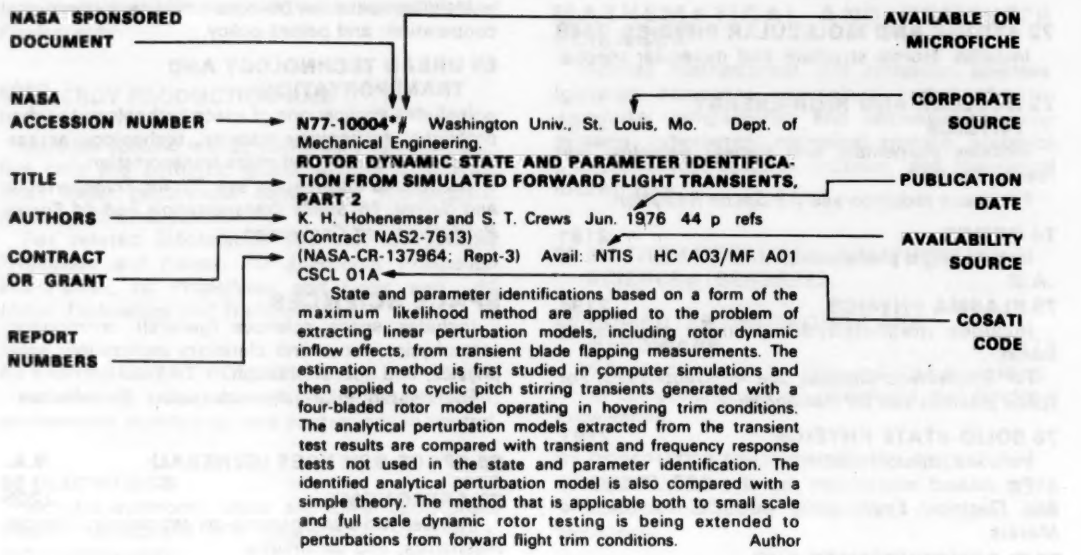
TYPICAL CITATION AND ABSTRACT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ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2
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State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, EVALUATION OF LOW-COST NAVIGATION SYSTEM

K.A. KIMBALL, U.S. Army, Aviation Psychology Division, *Ozark, Alabama* 36360 (DA0B6903)

To evaluate the potential for application of low-cost sensors and data processors as navigation aids during NOE and tactical instrument flight missions.

The approach in evaluating these devices will be to conduct in- flight testing. Flights will be conducted at NOE at low level to determine the accuracy and navigation aid this system affords.

ADDENDA: Supporting agency address is: MDRDC Aeromedical Research Lab., Ft. Rucker, AL 36362

SUPPORTED BY U.S. Dept. of Defense - Army

1.0002, EXPEDIENT SNOW ROADS AND LANDING FIELDS

P.R. JOHNSON, U.S. Army, Cold Reg. Res. & Engin. Lab., *Fort Wainwright, Alaska* (DA0D8149)

To evaluate the effectiveness of roads and landing fields built of snow to provide a suitable travel surface for wheeled and tracked vehicles or landing field for aircraft while minimizing damage to the underlying vegetation.

In the subarctic, work will be concentrated on methods of compacting the light cold snow so as to develop a snow pad with adequate strength and surface characteristics to carry medium-to-heavy truck traffic. Existing snow roads, if any, will be studied in terms of the methods of construction, traffic, terrain features, physical and mechanical properties of the packed snow, and the general acceptability of the road. In the arctic, special attention will be given to snow supply and induced drifting along with the terrain, snow and traffic characteristics. The protection offered the vegetative mat and ground below will be evaluated during the following summers by (1) examining the vegetative mat for mechanical damage and observing its thickness and growth, and (2) observing any reduction in the insulting effect of the vegetative mat by monitoring the depth of thaw, compared to undisturbed areas.

ADDENDA: Supporting agency address is: OCE Cold Regions Research and Eng. Lab., P.O. Box 282, Hanover, NH 03755

SUPPORTED BY U.S. Dept. of Defense - Army

1.0003, AUTOMATED STRENGTH AND STIFFNESS DESIGN OF MILITARY AIRCRAFT

K.E. KADRNKA, Rockwell International Corp., *Los Angeles, California* 90009 (DF140140; F33615-76-C-3161)

This effort will advance the use in industry of automated strength and stiffness sizing in the design of aircraft lifting surfaces. Efficient automated methods of design that include static and dynamic loading requirements are needed to reduce aircraft development time and increase structural reliability and operational effectiveness. This effort will transfer an automated static and dynamic design procedure for military aircraft structures (FASTOP) to practical design environments and determine the requirements for future design methods. These applications of FASTOP will allow the Air Force to expand the applicability of the FASTOP system, determine requirements for future design procedures, and demonstrate how FASTOP can be integrated into a total aircraft design process.

The contractor will select and study a military aircraft design using the FASTOP system. Problem set-up times, program discrepancies, recommendations for improvements, and a discussion of the role FASTOP could play in an overall aircraft design system will be documented by the contractor.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBRF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0004, FEASIBILITY INVESTIGATION FOR LIFT PERFORMANCE INDICATOR SYSTEM

W.J. HARRIS, Signal Companies Incorporated, *Torrance, California* 90509 (DA0D4083; DAAJ02-76-C-0036)

To provide helicopter crews engaged in cargo delivery missions with accurate and timely information on actual aircraft lift status so that positive actions can be taken to insure maximum safe utilization of the aircraft total lift capability.

This effort is an extension of prior research and development in which various elements relating to a lift margin indicating system were evaluated and in which the feasibility of such a system was established. In FY76, a system analysis and design study will be conducted to establish means for applying available technology, e.g., power prediction, real-time atmospheric density measurements, aircraft weight measurement, residual rotor lift at ground idle speed, etc. Follow-on efforts will include the synthesis, design, fabrication and test of a breadboard system after analysis of results. A full-scale flightworthy hard and software system will be designed, fabricated and flight tested.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R & D Lab., Eustis Dir., Ft. Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0005, CRASH DATA RECORDER INVESTIGATION

J. BIKOWSKI, United Technologies Corp., *Windsor Locks, Connecticut* 06096 (DA0D4068; DAAJ02-76-C-0058)

To design a flightworthy, low-cost data recording system to provide accurate crash impact conditions and causes. Determine the technical constraints and economics of the design, manufacture and operation of a recorder system for Army helicopters which will: (A) Reduce time, cost and inaccuracies of accident investigations; and (B) Provide for improved aircraft safety through corrective actions based upon sound crash data.

Utilizing new technology in micro-digital preprocessing, data storage, and miniaturized circuits: (A) Define flight/crash data to be recorded; (B) Design appropriate circuitry; (C) Breadboard and test system; and (D) Conduct economic, weight and size analyses with appropriate parameter/cost trade-offs.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R & D Lab., Eustis Dir., Ft. Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0006, PERFORM FLIGHT TEST OF GUIDED DROGUE
UNKNOWN, Beech Aircraft Corporation, *Wichita, Kansas* 67206 (DN590182; N00019-76-C-0555)

To improve the state-of-the art of aerial refueling capability under adverse weather conditions and to obtain greater assurance of successful engagement.

The contractor will design, manufacture and test the guided drogue.

ADDENDA: Supporting agency address is: Naval Rir Systems Command, Washington, D.C, 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0007, PROTOTYPE YC-141B AIRCRAFT
P. MACEK, U.S. Army, Natick Research & Dev. Command, *Natick, Massachusetts* 01760 (DA0H4191)

Participate in the prototype test program to insure that the Army's interest in the C-141 critical airdrop capability is considered and that no degradation to the existing capability will result from the lengthening of the fuselage.

Review test plans, assist in the preparation of flight test cards and recommend test designs which will insure recording of test results required by the Army in its engineering evaluation of the YC-141B prototype. Review film, telemetry traces and cinetheodolite trajectory space positioning reports to determine whether the current airdrop capability of the C-141A will be degraded as a result of its modification as the YC-141B stretch prototype aircraft. Prepare Army test requirements for the proposed government conducted comprehensive follow-on test program.

ADDENDA: Supporting agency address is: NARADCOM Natick R & D Command, Attn- DRXNM-UAS, Natick, MA 01670

SUPPORTED BY U.S. Dept. of Defense - Army

1.0008, REMOTELY PILOTED VEHICLE (RPV) ACTUATOR DESIGN
J. DONIGER, Bendix Corporation, *Hackensack, New Jersey* 07608 (DA0D4092; DAAJ02-77-C-0009)

To develop lightweight, low-cost, electromechanical, rotary actuators suitable for use in both rotary and fixed-wing RPV's that weigh from 120 to 300 pounds.

To design, fabricate, and test two sizes of flight control actuators for small Army RPV's in accordance with the specifications.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R & D Lab., Eustis Dir., Ft. Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0009, MEASUREMENT OF FATIGUE DAMAGE WITH DIFFERENTIAL SCANNING CALORIMETRY
P.N. ADLER, Grumman Corporation, *Bethpage, New York* 11714 (DN590205; N00019-76-C-0651)

To establish the applicability of the differential scanning calorimetric (DSC) technique of thermal analysis to monitor the structural reliability of aircraft during service.

DSC measurements are correlated with microstructural changes after varying degrees of fatigue exposure in two tempers of high-strength aluminum alloy 7050.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0010, SERVICE EVALUATION OF F-14 COMPOSITE MAIN LANDING GEAR STRUTDOOR
R. CARLSON, Grumman Corporation, *Bethpage, New York* 11714 (DN681284; N62269-75-C-0466)

To demonstrate the service durability and structural reliability of advanced fiber-reinforced composite aircraft structures under actual Navy operational usage. To determine the reproducibility of such structures when produced by a pilot-production program and to provide realistic manufacturing cost data which can be used as a basis for future economic projections. This work is in support of work unit ZA101, Aircraft Technology, agency accession no. DN681080.

A limited quantity of F-14 composite main landing gear strut doors using pilot-production practice and techniques will be fabricated. These composite doors, originally designed and developed under NAVAIRDEVCEN contract N62269-74-C-0535, will be installed on current fleet aircraft subjected to a variety of service usages and operating environments. The condition of these doors will be closely monitored periodically over the life of the aircraft. (The service evaluation of the composite doors is not included in the contract.) The manufacturing methods used will simulate large-scale production techniques, the quality of the doors so made will be assessed and manufacturing costs will be monitored closely.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehical Technology Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0011, MODULAR LIFE-CYCLE COST MODEL FOR ADVANCED AIRCRAFT SYSTEMS
B. RACHOWITZ, Grumman Corporation, *Bethpage, New York* 11714 (DF135570; F33615-76-C-3056)

Since operational support costs comprise such a large part of total life-cycle costs, these relationships are needed in order to evaluate the cost impact of alternative candidate designs and to effectively conduct trade studies which compare the cost/performance advantages of these competing designs. The objective of this study is to determine specific parametric relationships between selected operational concepts, primary performance characteristics, and life-cycle support costs which can be used to develop a model for estimating the operating and maintenance costs of future advanced military aircraft early in the design phase of the development program.

Study will be implemented to identify, analyze and quantify the relative cost sensitivity of a range of system parameters of the kind available early in the design process. Information derived will be used to generate parametric costing techniques and methodology for determining system support costs early in the design phase of an aircraft program. Computerized mathematical/statistical analysis models and techniques will be developed. Analytical tests will be formulated, capable of determining the degree of validity implicit in these models and the accuracy/adequacy of the methods developed.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0012, ACQUISITION OF OPERATIONAL DATA DURING NOE MISSIONS, ARMY HELICOPTERS
R. JOHNSON, Technology Incorporated, *Dayton, Ohio* 45431 (DA0D4074; DAAJ02-76-C-0065)

To instrument a helicopter for the purpose of measuring various flight parameters that can be used to define the usage (mission profile) of the aircraft when performing terrain following, nap-of-earth (NOE) operations. Such data as 'G' loads, control displacements and the conventional performance parameters (airspeed, altitude, rpm, etc.) will be recorded. An attempt will be made to reconstruct the mission profiles (NOE) flown through analysis of the measured data. The results of this program will be used to augment the large data bank already acquired on various operational helicopters for application in the design of future aircraft tailored to satisfy the Army's military goals.

An Army helicopter performing NOE training missions at Fort Rucker, Alabama, will be instrumented to permit the measurement and recording of various data such as flight loads (three axes of acceleration), control displacements, aircraft attitude and rates. Both an analog recorder and photo panel will be used to permit accurate assessment of the usage and flight path flown while performing NOE training assignments. The installation, maintenance, and monitoring of the equipment on board the aircraft will be performed on a non-interference basis until 50 hours of data are acquired, at which time the equipment will be removed.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R & D Lab., Eustis Dir., Ft. Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0013, HELICOPTER INTERNAL CARGO LOADING, RESTRAINT, AND UNLOADING INVESTIGATION
H.S. MANKEY, Standard Manufacturing Co. Inc, *Dallas, Texas* 75222 (DA0D4085; DAAJ02-76-C-0074)

To assess the extent to which operations associated with loading, unloading and safe restraint of cargoes internally transported in CH-47 and UTTAS helicopters affect aircraft turnaround time, and to determine the most effective technical approach for establishing improvement.

Current and projected loading, restraint, and unloading tasks for the CH-47 and UTTAS helicopters will be analyzed to determine the effect of each on time and manpower requirements for each operation, and for the overall helicopter turnaround time.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R & D Lab., Eustis Dir., Ft. Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0014, VIBRATORY ICE PROTECTION CONCEPT FOR HELICOPTER ROTOR BLADES
H. UPTON, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D4066; DAAJ02-76-C-0051)

To assess the effectiveness of the vibratory rotor blade deicing concept for application to various rotor blade designs such as the OH- 58A, UH-1, AH-1, CH-47, UTTAS, AAH, and ASH.

Analytical assessments will be made of five (5) methods of exciting rotor blade vibratory modes necessary to cause ice shedding in a controlled manner. Various design characteristics will be estimated such as weight, energy requirements, R & M, cost, performance penalties, and impact of vibratory modes upon helicopter component fatigue life. Laboratory tests will be conducted to examine various methods of system control, demonstrate functional capabilities and identify and evaluate functional problem areas.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R & D Lab., Eustis Dir., Ft. Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0015, EXPERIMENTAL INVESTIGATION OF UNSTEADY SEPARATION 12680-E
D.P. TELIONIS, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (DA0C5570; DAHC04-75-G-0067)

To investigate experimentally the flow properties in the neighborhood of separation within an unsteady boundary layer in an effort to verify the Sears-Telionis concept of unsteady separation. Relevance - the dynamic stall problem which occurs on the retreating blade of an advancing helicopter rotor can be explained in terms of an unsteady turbulent boundary layer separation. The description of this physical process is based on the Sears-Telionis unsteady separation concept. This concept is fundamental to all dynamic stall research work being carried out at AMRDL-Ames directorate.

A glycerin-water mixture will be used to yield low Reynolds numbers and thick boundary layers with reasonable velocities. Separation will be induced by time-dependent adverse pressure gradients. Hydrogen bubbles and ink dyes will be used for flow visualization.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Research Triangle Park, N.C. 27709

SUPPORTED BY U.S. Dept. of Defense - Army

1.0016, MICROWAVE ICE PROTECTION CONCEPT FOR HELICOPTER ROTOR BLADES
B. MAGENHEIM, Mechanics Research Inc., *McLean, Virginia* 22101 (DA0D4075; DAAJ02-76-C-0052)

The objectives of this contract are to experimentally verify microwave parameters established under contract DAAJ02-75-C-0042 to demonstrate concept feasibility, and establish characteristics, capabilities, limitations, and associated penalties of the concept.

The contractor through laboratory experiments will measure microwave parameters for correlation to theoretically established parameters, demonstrate the effectiveness of the concept to prevent ice formation, melt the ice/surface interface bond and detect presence of surface ice. Assessments of applicability of the concept to various rotor blade designs will be performed including estimation of weight, cost, R & M, detectability, power requirements, etc.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R & D Lab., Eustis Dir., Ft. Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, ROTATING VALVE FOR VELOCITY COUPLED COMBUSTION RESPONSE STUDIES
R.S. BROWN, United Technologies Corp., *Sunnyvale, California* 94088 (DF047200; F49620-77-C-0048)

AF function - solid propellant rocket motors are a cost-effective propulsion system for strategic and tactical weapons. Deficiency - definitive methods of characterizing velocity coupled combustion instabilities in rocket motors are not available. Objective - this program will explore the rotating valve method to measure velocity coupled combustion effects. How work contributes - successful development of this technique will provide a laboratory method for measuring this propellant property. This property can then be used in motor design studies, together with other data, to estimate the probability of the appearance of spontaneous pressure oscillations.

Velocity oscillations of controlled frequency and amplitude may be generated in a test motor by simultaneously operating rotating values at each end of the motor, 180 degrees out of phase. Analytical studies will improve the accuracy of the transient ballistics model, explore its limitations, and estimate the effects of experimental uncertainties. Concurrent experimental studies will construct the apparatus, compare its performance with predictions under controlled cold flow conditions, and assess the apparatus performance and appropriateness of the method by conduction combustion tests.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0002, FUNDAMENTAL APPROACH TO PROBLEMS IN CERAMIC ENGINEERING
H. LIEBOWITZ, George Washington University, School of Engin. & Appl. Sci., *Washington, District of Columbia* 20037 (DF046050; AF-AFOSR-3114-77)

AF function - this proposed research primarily falls in the 2.1 research objectives which deal with failure processes. Basic research to identify new families of ceramic materials capable of economical consolidation to densities approaching 100 percent and possessing improved creep and thermal fatigue resistance is needed for extending limits of future-generation expendable and recoverable high-temperature turbine engine components. A rational basis for the development of alloys, nonmetallic materials, ceramics, and composites which are stronger is needed for all Air Force systems. Deficiency - failure processes such as fatigue, fracture, and creep are in most cases intimately related to the microstructure of alloys, polymers, ceramics, and composites. Understanding of these processes, properties, and mechanisms must be integrated with appropriate constitutive equations and appropriate failure criteria. Considerable progress can be achieved in structural reliability and integrity as a result of some basic studies. Objective - an alternative approach to problems in ceramic engineering is proposed, exploiting the constructs and methodology of solid-state physics. It is proposed to computer-simulate crack tips, dislocation cores, and grain boundaries within a lattice model employing realistic potentials. The lattice model will be based on a variation of the lattice statics method. Contribution - this research is a part of a comprehensive program to use statistical mechanics on real systems.

This proposal suggests two areas of investigation which provide a more accurate and realistic computer simulation of flaws. The first development will utilize a variation of the lattice statics method in order to treat a fully discrete lattice. This will eliminate the effects of artificially truncating the size of the discrete region. The second development will be in the area of interatomic potentials. No matter how extensive the computer simulation, if it employs unrealistic potentials as input data, then the results must carry the same degree of uncertainty. The bulk of the computer simulation work has employed empirical potentials. This work will derive accurate potentials for ceramic materials by using techniques from quantum chemistry. Two modifications of Hartree-Fock will be explored which should yield good approximations to the Hartree-Fock solutions in reasonable computational times.

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0003, BASIC STUDIES RELATING TO THE SYNTHESIS OF UNSYMMETRICAL DIMETHYL HYDRAZINE AND MONOMETHYL HYDRAZINE BY CHLORAMINATION

H.H. SISLER, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (DF042070; AF-AFOSR-2915-76)

AF function - substituted hydrazines are components of several presently used liquid rocket fuel mixtures. Monomethyl hydrazine (MMH) is a major component of the fuel for the proposed space shuttle. The principal use of unsymmetrical dimethyl hydrazine (UDMH) is in the Air Force Titan II and Titan III rocket. Deficiency - due to the carcinogenic nature of the presently used starting material for making UDMH, there is a need for kinetic and mechanisms studies of alternate processes for making the fuel. Objective - this research is aimed at better understanding kinetics and mechanisms of the Sisler process for making UDMH and MMH. How work contributes - the information obtained will be exceedingly valuable in optimizing the manufacture of UDMH and MMH by the Sisler chloramination reaction.

This research is aimed at (1) determination of kinetic data for the reactions of chloramine with dimethylamine, unsymmetrical dimethyl hydrazine, monomethylamine, and monomethyl hydrazine, (2) determination of the nature and distribution of products from the reaction of chloramine with dimethylamine, unsymmetrical dimethyl hydrazine, monomethylamine, and monomethyl hydrazine, (3) mechanism study of formation of undesirable side products, and (4) study of the effect of hydroxide ion on the nature and distribution of products from the chloramine-dimethylamine reaction and then on the side reactions.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0004, THEORETICAL INVESTIGATION OF THE EXCITATION STRUCTURE AND OPTICAL PROPERTIES OF TITANIUM, VANADIUM AND THEIR OXIDES

M.W. RIBARSKY, Georgia Inst. of Technology, Graduate School, *Atlanta, Georgia* 30332 (DF045830; AF-AFOSR-3108-76)

AF function - this proposed research primarily falls in the 2.1 and 2.2 research objectives which deal with basic research to identify approaches leading to the formation of new titanium alloy systems capable of sustained operation at temperatures up to 1600 degrees F. Also predictability of the effect of corrosion on the loadbearing capability of structure requires fundamental knowledge of chemical, electrochemical, mechanical and metallurgical influences, and their interaction. Further research is needed to understand and prevent degradation of a broad range of materials exposed to oxidizing environments at elevated temperatures. Deficiency - potential future high-performance Air Force aircraft are forecasted to be operating at higher dynamic pressures and temperatures. Continued use of aluminum alloys to fulfill future objectives remains an attractive economical approach; however, alloy systems of titanium, steels and superalloys which feature improved resistance to repeated high stress at high temperatures are needed. Objective - to study the electronic excitation structure of the transition metals and their compounds. The study will include the effects of correlation of the excited electron with the surrounding medium, relaxation of the electrons around the hole left by the excitation, and the interaction of the excited electron with its hole. Recent results have shown that all of these effects must be included in order to obtain a detailed understanding of the materials. Contribution - this research is a part of a comprehensive program in statistical mechanics.

The approach taken by this proposal is to investigate the properties of transition metals and their compounds, especially the oxides, with calculations centered around the excitation structure including correlation, relaxation and particle-hole interactions. These effects have to be included if understanding of the contributions of the localized d-band to the excitation structure is to be made, and in turn the method contemplated will provide a good description of the d-bands. The proposed program will start with calculations on titanium and vanadium and their oxides since these materials involve the simplest transition metals. The calculation will include investigations of the optical properties, lattice dynamics and electrical conductivity of these materials.

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0005, EXPERIMENTAL AND THEORETICAL STUDIES OF INTRAMOLECULAR AND INTERMOLECULAR DYNAMICS

S.A. RICE, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (DF045720; F49620-76-C-0017)

AF function - reconnaissance, surveillance, communication and other areas require developments in new, stable lasers. Deficiency - there is a requirement for an understanding and design of systems with selective reactivity and/or energy exchange. Objectives - investigate aspects of the dynamics of intramolecular and intermolecular energy transfer and related phenomena. Provide both experimental information and theoretical descriptions which will elucidate: (1) primary processes in unimolecular reactions, (2) the pathways of energy transfer in bimolecular encounters and the relationships of these with physical processes, such as quenching of excitation, and chemical reactions, (3) the nature of the reaction products and the energy disposal between them for given initial states of the reactants. How work contributes - unravelling of the many molecular processes which underlie these phenomena will contribute to the store of concepts and information needed for upper-atmosphere chemistry and physics, potential chemical lasers and the generation of chemical intermediates in defined states of excitation.

(1) Determine the rate of intramolecular vibrational relaxation and the pathways for decay of vibrational excitation in the absence of collisions, (2) determine whether intramolecular vibrational relaxation is fast or slow relative to chemical reactions, (3) determine the nature of intramolecular vibrational energy transfer induced by collisions, (4) determine the influence of initial state selection and coupling between various degrees of freedom on the course and rate of unimolecular reactions.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0006, INTERACTION AMONG INHOMOGENEITIES 14127-E

T. MURA, Northwestern University, Technological Institute, *Evanston, Illinois* 60201 (DA0E9287; DAAG29 77 G0042)

To study the elastic interactions among inhomogeneities under applied loads and to apply the results to constitutive equations and fracture mechanics. Improvements in fracture mechanics could provide results applicable to helicopter structure design. This method may provide a new approach to cracks under mixed modes and crack branching in composite materials.

A theoretical solution for two ellipsoidal inhomogeneities in an infinite medium under a linear applied stress at infinity will be the starting point. This will be generalized to the case where many ellipsoidal inhomogeneities are present.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, N.C. 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0007, EXPERIMENTAL AND THEORETICAL WORK IN CHEMICAL DYNAMICS AND NUCLEATION

J. ROSS, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF046850; AF-AFOSR-3214-77)

AF function - effects of earths' atmosphere on Air Force operations. Deficiency - the mechanism of and dynamics of atom transfer to molecules, the effect of chemical instabilities in illuminated reactive and non-reactive systems and nucleation phenomena are not completely understood. This affects understanding of the depletion of the ozone layer and the removal of contaminants from the atmosphere. Objective - perform experimental and theoretical studies of the chemical dynamics of atom transfer reactions and theoretical research on the stochastic theory of nucleation and chemical instabilities. How work contributes - studies on oxygen atom transfer from ozone to molecular acceptors such as NO and SO2 will provide new information on this reaction relevant to atmospheric composition. Nucleation and chemical instabilities will provide insight on atmospheric processes induced by molecular collisions and absorption of radiation.

Reactions of ozone with molecules and bromine with C1O2 will be studied in a molecular beam apparatus. Total reaction cross sections, reaction probability and its variation with impact parameter, and threshold energies and distances for the reaction will be determined. Theoretical studies of the collision dynamics will include a statistical model as the lowest order of approximation. New coupling mechanisms giving rise to chemical instabilities will be sought. Oscillations and reactions with feedback loops due to auto- or cross-catalysis will be examined. Nucleation in unstable chemical systems considers the theory of ordinary nucleation and the kinetics of phase transitions.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0008, PREPARATION AND CHARACTERIZATION OF INFRARED MATERIALS

A.F. WITT, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF046960; AF-AFOSR-3202-77)

AF function - aerospace communications, surveillance and detection systems require electrooptical devices which exploit the special properties and interactions of infrared radiation with solid-state materials. Opportunity - the far infrared region of the electromagnetic spectrum has been virtually unexplored for airborne and satellite applications. Sophisticated electrooptical techniques in narrow band-gap compound semiconductors offer promise for electrooptical microcircuitry in the spectral range 10 to 100 micrometers. Objective -the aim of this research is to optimize compositional homogeneity and to control compositional variations in III-V (InSb) and II-VI (CdTe) semiconductor compounds. The goal is to establish quantitative relationships between growth parameters and materials characteristics and to utilize the special properties of these materials for electrooptical device concepts. How work contributes - infrared detectors and tunable infrared sources of coherent radiation require solid-state materials with narrow band gaps, controlled carrier concentrations and doping to provide optimal performance characteristics.

InSb with low doping levels is grown in a modified Czochralski system. Controlled modulation of dopant concentrations over constant growth distances ranging from 50 to 100 micrometers is to be achieved by transmission of appropriate current pulses across the crystal-melt interface during growth. The CdTe is to be grown in a seeded Bridgman- type system making use of the interface demarcation technique, differential heat pipes for effective gradient control and electric current transmission for compositional control in the segregation determining boundary layer at the growth interface. The study of the growth of heavily Bi-doped InSb is to be achieved by a modified Czochralski technique and by a seeded Bridgman technique using a continuous direct electric current to decrease the dopant accumulation in the diffusion boundary layer. All materials are to be quantitatively characterized for compositional distribution, crystalline perfection and subsequently for their specific device performance.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0009, SOLID-STATE THERMAL SWITCH

L.A. SHEPARD, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4799)

The Army has a continuing need for very simple and rugged electronic devices of high reliability. The reduction of the number of components in a device to the absolute minimum for operation enhances the system reliability. Metal-insulator transition compounds represent the simplest solid-state devices for thermal switching of electric current--a single phase of a simple material that undergoes a large reduction in conductivity at the transition temperature.

This program will be concerned with the adaptation of the most suitable of the metal-insulator compounds to aircraft and missile applications. Consideration will be given to volume and current carrying capacity requirements for the several temperature ranges. Polycrystalline materials will be prepared by solid-state reaction in order to measure the bulk properties. Attempts will be made to grow single crystals of the compounds by molten flux techniques. Stability with temperature cycling, and effect of pressure and stoichiometry will be investigated.

ADDENDA: Supporting agency address is: DARCOM Materials & Mechanics Res. Ctr., Attn- DRXMR-D, Watertown, MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0010, STUDIES IN CHEMICAL REACTIVITY

R.W. CARR, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (EY-76-S-02-2026)

Investigation of some reactions of importance in the earth's atmosphere will be done. The reaction of hydroxyl radicals with olefins plays a central role in the atmospheric photooxidation of olefins in photochemical smog. The mechanism of the reaction of hydroxyl radicals with propylene will be studied. Whether the species CHFCl2 and CHF2Cl can be used as refrigerants posing little danger to the environment after release to the atmosphere depends upon the fate of the CFCl2 and CF2Cl radicals produced by reaction of the parent species with OH radicals in the troposphere. The reaction of CFCl2 and CF2Cl radicals with molecular oxygen will be investigated, since this is expected to be the first step in the atmospheric degradation of these species. Chemical mechanisms for photochemical smog are lengthy, and require large amounts of computer time when incorporated into mathematical models for urban airsheds. Investigations will be done seeking to find rational methods, by the use of computer techniques, to reduce chemical mechanisms to the minimum set of reactions for accurate prediction of pollutant concentrations. The collisional deactivation of polyatomic hydrocarbons chemically activated to about 100 kcal/mole is being studied. Deactivation of a homologous series of chemically activated cyclopropanes by polyatomic deactivator species will be investigated. The kinetics of methylene reactions will be studied by flash photolysis with time-resolved mass spectrometry. A search for luminescence from CH2(1B1) formed from ketene photolysis in the far ultraviolet will be done.

RESULTS: The reaction of hydroxyl radicals with propylene has been investigated by steady-illumination photolysis methods. Evidence for H- abstraction by OH was found. The collisional deactivation of methylcyclobutane and ethylcyclobutane by cyclobutane and cyclohexane, respectively, occurs in decrements of 4 to 5 kcal/mole, based on a stepladder model. Reaction of CHCl2F and CHClF2 with hydroxyl radicals was found to be an efficient tropospheric sink for these species. Ground-level input fluxes of these species are predicted to be reduced by 90 percent or greater at the tropophase, thus involving less risk for stratospheric ozone depletion than the non-hydrogenated chlorofluorocarbons CF2Cl2 and CFCl3.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

3.0011, HYDROGEN EMBRITTLEMENT MECHANISMS IN TITANIUM AND ALUMINUM ALLOYS

W.W. GERBERICH, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (DF046300; AF-AFOSR-3133-77)

AF function - hydrogen embrittlement is a serious problem that causes mechanical property degradation in our most significant aircraft materials including steels, titanium, aluminum and nickel-base alloys. The various forms of hydrogen-related mechanical property degradation severely restrict the serviceability of important aircraft materials. Opportunity - basic understanding of the manner by which hydrogen acts to reduce mechanical strength and cause failures is important if we are to minimize and control these forms of attack. Objective - this research will investigate the hydrogen embrittlement susceptibility of titanium and aluminum alloys from both macroscopic and microscopic points of view. Macroscopic studies will focus on a fracture mechanics evaluation of the effects of gaseous and internal hydrogen on threshold stress intensities and crack growth conditions; microscopic studies will focus on the mechanistic details of nucleation and growth processes in concentration gradients. How work contributes - this not only has ramifications to alloy design, but carries specific ramifications to component design where sustained load, spectrum fatigue loading or corrosion fatigue might be encountered.

Factors to be investigated include: specimen thickness, internal versus external hydrogen, temperature effects, phase stability, hydride formation, decohesion at particle-matrix interfaces, and in situ concentration profiles.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0012, RESEARCH ON CORROSION FATIGUE OF AIRCRAFT STRUCTURAL MATERIALS

D.W. HOEPPNER, Univ. of Missouri, Graduate School, *Columbia, Missouri* 65202 (DF046650; AF-AFOSR-3178-77)

AF function - Air Force flight vehicles are fabricated of complex, mixed materials that each exhibit different reactions to environmental effects. In order to improve the serviceability of Air Force vehicles, research should now be done to better understand the role of selected environs during the phenomenalistic problem of corrosion fatigue. Opportunity - the combined effects of corrosion and fatigue on the loss of ductility and stiffness for aerospace aluminum alloys are of real concern to airplane designers for the long term. Research in this area would provide much-needed answers for questions vital to life cycle problems of aerospace structures. Objective - this proposed effort will elucidate mechanisms of corrosion fatigue and lend insight into the corrosion fatigue phenomena that heretofore has not been available. Application of this information to materials engineering criteria, as well as fatigue life analyses, will aid in improving safety, reliability, maintainability and structural integrity of aircraft. How work contributes - this research would contribute to the AFOSR mission in the area of a continuing effort on problems relating to fatigue and fracture of metals in the field of structural materials mechanics.

Experimentally, this program will evaluate the effect of environment, r ratio, frequency, wave form and periodic overload for two aluminum alloys, 2024-T851 and 2124-T3. Analytically, the data will be modeled to approaches for prevention, prediction and alleviation of corrosion fatigue.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0013, DIFFUSIONAL CREEP OF MULTICOMPONENT SYSTEMS

L.C. LI, Univ. of Rochester, School of Engin. & Appl. Sci., *Rochester, New York* 14627 (EY-76-S-02-2296)

The concentrated efforts made this year established impression creep testing as a convenient substitute for conventional creep testing using bulk specimens. This enables us now to make detailed studies on multicomponent and multiprocess systems. Single crystals of beta-tin, Cu-Ni, and Bi-Sb will be studied in the next period of this project. Attention will be paid to the transition of activation processes and the composition variation of activation parameters. Three-variable constitutive equations involving temperature, stress, and composition will be developed for both Cu-Ni and Bi-Sb systems. Attempt will be made to understand the two activation energies in beta-tin single crystals. In addition, diffusive mechanisms in amorphous alloys will be studied by creep and radiation damage (swelling) by high-energy ions to test some ideas based on the absence of crystal lattices in amorphous systems.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

3.0014, RADIATION EFFECTS TO BCC REFRACTORY METALS AND ALLOYS

J. MOTEFF, Univ. of Cincinnati, School of Engineering, *Cincinnati, Ohio* 45221 (EY-76-S-02-2093)

The defect states in the refractory metals Mo, Mo-O.5Ti, Nb-1Zr, W and W-25Re all irradiated at elevated temperatures are evaluated by means of transmission electron microscopy, resistivity, and hardness measurements. The influence of the observed defect structure on the hardening behavior is also evaluated, with particular attention to the development of the concept of a strength microprobe using a hot-hardness tester. Tensile and creep-rupture tests will be initiated on similar irradiated metals.

RESULTS: It is shown that the increased impurity level in molybdenum reduces the degree of radiation-induced swelling at temperatures between about 200 to 900 degrees C. Room temperature hardening in molybdenum can be reasonably predicted based on the observable defect structure. Impurity level does not significantly affect the defect recovery stages of tungsten and molybdenum.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

3.0015, ELASTOHYDRODYNAMIC LUBRICATION STUDIES

J.N. CRISP, Univ. of Dayton, School of Engineering, *Dayton, Ohio* 45409 (DF047460; AF-AFOSR-3229-77)

AF function - propulsion systems and other mechanical devices for advances aerospace vehicles require improved lubricants which will withstand a wider range of temperature conditions, greater contact loads and higher shear rates. Deficiency - lubricant materials continue to fail at elevated temperatures and under high loads due to complex change in their physical, chemical and elastohydrodynamic (EHD) properties. Objective - understand the effects of elastically deformed contact surface on boundary lubrication performance. How work contributes - information gained from this research will be used to formulate improved lubricants for further AF application.

The proposed research is intended to prepare the necessary computer programs to determine the pressure distribution from measured film thickness for the isothermal ehd point conjunction and to extend the research to include the temperature distribution within the EHD point contact conjunction.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0016, FATIGUE CRACK PROPAGATION IN POLYMERIC MATERIALS 14409-MS

R.W. HERTZBERG, Lehigh University, School of Engin. & Phys. Sci., *Bethlehem, Pennsylvania* 18015 (DA0E9233; DAAG29 76 G0336)

To study (A) the relative fatigue crack propagation (FCP) frequency sensitivity of polymers over a range of temperature, (B) the effect of molecular weight and molecular weight distribution on FCP behavior in polymers, (C) the kinetics and micromechanisms of cyclically induced craze and crack growth in polymeric solids. Relevance - The research is relevant to a number of Army problems in flight vehicles (e.g., in windshields, airframe structures, etc.) and to a wide range of structural and nonstructural Army applications where plastics and polymer-

based composites are coming into usage as substitutes for metals and alloys because of lighter weight, cost savings, and other factors.

FCP frequency sensitivity will be studied with the aid of transition measurements (related to segmental molecular motions). Frequency sensitivity and propensity for discontinuous crack extension will be examined as a function of molecular weight and molecular weight distribution. Electron fractography would be employed in studies of crack morphology and to assist in identification of the micromechanisms underlying crack growth.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, N.C. 27709

SUPPORTED BY U.S. Dept. of Defense - Army

3.0017, MOSSBAUER SPECTROSCOPY OF PASSIVE FILMS

H. LEIDHEISER, Lehigh University, School of Arts & Sciences, *Bethlehem, Pennsylvania* 18015 (INT76-14748)

The surface of active, thermodynamically unstable metals such as iron, zinc, titanium, and stainless steel is given a thin, protective 'passive film' coating when treated under highly oxidizing conditions in aqueous solution. Important in the onset of passitivity are film thickness, structural perfection, and elemental composition. Theoretical models are needed to explain the cause of passivity and film-growth and dissolution kinetics. It is the purpose of this research to advance the development of emission Mossbauer spectroscopy for clarification of the composition of passive films formed on tin in aqueous media.

The polarization curve of tin under potentiostatic conditions will be determined in borate solution. The Mossbauer emission spectrum and the rate of dissolution of tin will be determined at several potentials in the passive range using samples whose surface is enriched in Sn-119m. The composition of the film will be determined by comparing the Mossbauer parameters obtained from the spectra of the passive film with known spectra and of emission spectra of compounds prepared in the laboratory.

This work will be conducted in cooperation with Attila Vertes, Lorand Eotvos University, Budapest, Hungary.

SUPPORTED BY U.S. Natl. Science Foundation

3.0018, INFRARED SPECTRA OF FLUID FILMS UNDER CONDITIONS OF INCIPIENT BEARING FAILURE

J. LAUER, Suntech Incorporated, *Marcus Hook, Pennsylvania* 19061 (DF045910; F49620-76-C-0042)

AF function - propulsion systems for advanced aerospace vehicles require improved lubricants which will withstand a wider range of temperature conditions, greater contact loads and higher shear rates. Deficiency - synthetic lubricants continue to fail at elevated temperatures due to complex chemical and physical interactions of the bulk lubricant with its environment and with both static and moving metal surfaces. Objective - understand the bulk and boundary layer chemical-physical properties of lubricants to determine causes of bearing failure. How work contributes - information gained from this research will be used to formulate improved lubricants for AF application that can withstand conditions of extremely high temperatures, pressures and shear rates.

Infrared emission spectra will be obtained through a window in an operating sliding bearing lubricated by a number of standard fluids. A variety of realistic operating conditions will be probed. The spectra will be analyzed for chemical and physical changes in the fluids (e.g., decomposition, glass transitions), fluid film and metal surface temperatures, and molecular alignment by polarizations. Conditions leading to bearing failure will be probed.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0019, PROTECTION OF CAST MAGNESIUM

A. GALLACCIO, U.S. Army, Pitman Dunn Research Labs., *Philadelphia, Pennsylvania* 19137 (DA0B0620)

The purpose of this task is to determine optimum surface treating and coating systems for protection of cast magnesium alloys AZ91C-T6, EZ33A-T5, and ZE41A-T5, and concurrently to ascertain minimal compromise of fatigue endurance of the castings coated with different protective systems. Optimum protective systems are required for use on cast magnesium housings and parts employed in Army helicopters, and for housings and mounting plates for weaponry and electronic equipment. This task is in support of major thrusts in aircraft, air-defense, weapons, warhead and guidance systems.

Failures of protective systems applied to cast magnesium power transmission housings (helicopters, AVSCOM), to arming equipment mounting plates (warheads, MUCOM-PA) and to housings for electronic sensing and guidance packs (HDL) have led to premature corrosion and increased maintenance. Where electrical continuity of the magnesium surfaces is not required, protective systems which are specified frequently employ chromate pretreatment in addition to a resin finish coating system. For a more effective protection system, anodic surface treatment is recommended where the fatigue strength of the castings will not be compromised. Where electrical continuity is required, electrodeposited metal barrier coatings comprised of a copper preplate and a nickel barrier overplate are used. This system is breeched even in relatively mild environments because of the very unfavorable anode- cathode relationship of metallic coating systems normally specified (Cu- Ni, Cu-Sn, or Sn-Zn); these have marked potential protection deficiency. The development of metallic coatings systems which are more compatible with and protective of magnesium under atmospheric conditions containing chlorides and covering the full range of humidity (with periodic condensation) is being pursued. Plated and metal-rich coatings will be considered.

ADDENDA: Supporting agency address is: ARMCOM Pitman-Dunn Lab., Frankford Arsenal, Philadelphia, PA 19137

SUPPORTED BY U.S. Dept. of Defense - Army

3.0020, RESEARCH ON METHODS TO IMPROVE THE PROPORTIONAL LIMIT OF BE/TI COMPOSITES

G.J. LONDON, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN781164)

To improve the proportional limit of Be/Ti powder-powder extrusions to a target minimum of 40,000 psi with minimum degradation to other mechanical properties.

Experimental Be/Ti powder-powder extrusions will be prepared utilizing either commercially pure or moderately alloyed Ti as the matrix with varied extrusion rates and temperatures. The proportional limit and other mechanical properties will be determined.

ADDENDA: Supporting agency address is: Naval Air Systems Command Tech. Admin. (Aero and Structures), Washington, D.C.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0021, MECHANISM OF TURBINE ENGINE LUBRICANT DEPOSITION

P. CUELLER, Southwest Research Institute, *San Antonio, Texas* 78228 (DF458710; F33615-76-C-2020)

Develop theory that will lead to an understanding of, and ultimately describe the lubricant chemistry associated with the mechanism of lubricant deposition.

Develop test techniques using the precision research rig developed under 30480635, to precisely control and measure all test parameters. Observe oil deposition behavior using known lubricant basestocks and additive combinations. Compare results with analytical techniques being developed under 30480626.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory SFL, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0022, A LOW-PRESSURE APPROACH TO THE FORMATION AND STUDY OF EXCIPLEX SYSTEMS

G. SANZONE, Virginia Poly. Inst. & St. U., School of Arts & Sciences, *Blacksburg, Virginia* 24061 (E(11-1)2810)

An experimental apparatus is proposed for the formation of excimers in their van der Waals state by using a low-temperature free-expansion technique. The apparatus will incorporate a low-energy electron beam for resonant excitation of the excimers to excited states, a synchronous mass spectrometer, and a tunable flash-excited dye laser.

Studies will be made on rare gas excimers, rare gas-oxide excimers, and rare gas halide excimers. These studies will include: (1) Measurements of the concentration of ground state dimers. (2) The electron-excitation cross sections from the ground dimer state to various excited states. (3) The total collisional deactivation cross sections for the excited excimer states. (4) Photon-excitation cross sections for upward-bound transitions. Metastable rare gas atom reactions with various molecules such as CS, OCS, and CO2 will be studied to determine reactive products and excitation cross sections. Collision deactivation of excited radicals (such as group IV and group VI radicals) will also be studied.

RESULTS: The molecular beam system is under construction and is about 70 percent complete.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - L.F.D.

3.0023, TRIBO-EMISSION FROM OXIDE LAYERS ON METALS

P. BRAUNLICH, Washington State University, Graduate School, *Pullman, Washington* 99163 (DF047170; F49620-77-C-0042)

AF function - future high-performance aircraft will employ an increasing amount of adhesively bonded structures. Deficiency - in order to obtain maximum strength, metal components are annodized to form a thin oxidized layer and the adhesive is then used to bond these layers together. The mechanical strength and other properties of the annodized oxide must be determined in order to insure compatibility and strength in the bonded region. Objective - the objective of this research is to examine the fracture dynamics and micromechanics of thin, annodized oxide films on metals by measuring the tribo-emission of charged particles during early stages of microcracking. How work contributes - analysis of the emitted particles will provide greater understanding and optimization of the oxide films grown on metals prior to adhesive bonding.

Tribo-emission of electrons, negative and positive ions and photons will be measured as a function of stress, strain, and fabrication variables. The micro imperfections, chemical and mechanical, will be characterized.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0024, INVESTIGATION OF LOW-COST SOLAR CELLS BASED ON CUPROUS OXIDE

L.C. OLSEN, Univ. of Washington, Joint Center For Graduate Stu., *Richland, Washington* 99352 (AER75-20501 A01)

This project is a continuation of the research on the earlier grant (AER 75-23453) to investigate the photovoltaic properties of thin-film solar cells based on cuprous oxide, particularly with respect to their potential as a low-cost solar cell. Specific objectives for the two- year effort are: (1) to demonstrate greater than 4 per cent power conversion efficiency for an AM 1 solar spectrum with improved Cu/Cu2O backwall solar cells, (2) to fabricate and evaluate heterojunction Cu2O solar cells, and (3) to establish Cu2O doping approaches to improve minority carrier properties.

SUPPORTED BY U.S. Natl. Science Foundation

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, FLUIDIC FUEL CONTROL FOR TURBINES

D. SCHAFFER, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DA0F5761; DAAG39-76-C-0129)

To fabricate, test, and deliver a fluidic fuel control and air bleed load control system for the AiResearch GTCP85-180 gas turbine engine.

A fluidic speed and temperature circuit interfaced with an electronic circuit controls the engine fuel valve. Three control systems are to be delivered and one system will be engine tested for 50 hours.

ADDENDA: Supporting agency address is: DARCOM Harry Diamond Laboratories, 2800 Powder Mill Road, Adelphi, MD 20783

SUPPORTED BY U.S. Dept. of Defense - Army

4.0002, FINE SCALE STRUCTURE OF TURBULENT VELOCITY FIELDS

F.H. CHAMPAGNE, Univ. of California, School of Engineering, *San Diego, California* 92038 (DF046560; AF-AFOSR-3172-77)

AF function - advanced aerospace vehicles. Deficiency - lack of understanding about turbulence and turbulent flows. Objective - investigate the phenomenon of relaminarization of turbulent pipe flow and the structure of the atmospheric surface layer. How work contributes - better knowledge of the basic mechanism of the relaminarization process will provide a better understanding of turbulence and transition to turbulence. This will be directly applicable to the design of future aerospace vehicles.

An experimental program for the relaminarization of turbulent pipe flow will be established with the following goals: 1) establish the minimum downstream Reynolds number for which the flow remains turbulent through the diffuser and downstream, 2) measure the development of the mean velocity field, 3) measure the decay rate of the turbulent velocity components' shear stress and their respective spectra and co-spectra at various locations, and 4) examine the turbulent energy at various phases of the reverse transition process. The possible relationship between the organized structure of surface atmospheric data and laboratory shear flows will be investigated.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0003, ANTENNA ADAPTER APPLIQUE FOR PHASE FRONT HOMING

N. MARCHAND, Marchand Electronic Labs. Inc., *Greenwich, Connecticut* 06830 (DA0D2801)

The objective of this program is to develop an applique unit that will provide compatibility between AN/ARC-114 radios equipped with phase front homing and existing aircraft homing antennas. The phase front homing technique offers significant improvement over conventional homing systems when used in standard vhf/fm receivers; however, existing homing antennas are incompatible with this technique. The development of an applique would complete the phase front homing system and, therefore, insure the proper fielding of phase front homing into the aircraft system.

It is envisioned that the applique will be a small, lightweight unit mounted between the homing receiver and the homing antennas. When phase information is lost, the applique will automatically provide a signal to the homing indicator indicating the true direction to the target.

ADDENDA: Supporting agency address is: ECOM Avionics Laboratory, U.S. Army Electronics Command, Fort Monmouth, N.J. 07703

SUPPORTED BY U.S. Dept. of Defense - Army

4.0004, STRUCTURE OF AUTOMATIC CONTROL SYSTEMS

A.S. MORSE, Yale University, School of Engineering, *New Haven, Connecticut* 06520 (DF046570; AF-AFOSR-3176-77)

AF function - the design of aerospace and turbojet control systems. Deficiency - the control process is still poorly understood for nonlinear and time-varying systems. Objective - the objective of this research program is to develop concrete analysis and synthesis methods for dealing with the engineering problems en-

countered in the design of complex control and information systems. How work contributes - this work could provide new aspects from which to analyze the control design problem.

Research will be made in a number of important design problems associated with the identification and control of linear multivariable systems. Included will be a fundamental study of self-tuning systems with the objective of developing effective techniques for designing such systems so that they function reliably over a reasonable range of process operating conditions - the study is motivated, in part, by the control requirements of proposed, high-performance turbojet engines. With the purpose of realizing reliable identification and modeling procedures for dynamical systems, an investigation will be made of the basic properties of multilinearly parameterized dynamical models. An effort will be made to develop systematic procedures for parameterizing or reparameterizing process models in a form suitable for identification.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0005, FAILURE OF METAL MECHANICAL JOINTS UNDER BLAST LOADS

C.A. ROSS, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32611 (DF047900; AF-AFOSR-3237-77)

AF function - to add needed knowledge in the area of aerospace vehicles, propulsion systems and weaponry. The failure of structural elements because of damage by dynamic blast loads is phenomenologically complex and improved modeling methods are badly needed. Deficiency - in aerospace applications, the boundaries of many structural elements are bolted or riveted joints. As such, these joints are not to be traditionally modeled as fixed, simply supported or free conditions. In addition, computer modeling of these complexities has proven to be cost prohibitive. Therefore, a deficiency exists and work must be done to overcome same. Objective - this research will use energy methods as a prerequisite study procedure for analytical modeling of joint degradation from blast loads. Through the use of energy methods and analytical modeling, a better understanding of mechanical joints should evolve. How work contributes - additional scientific information about joints will serve to improve aerospace vehicles, propulsion systems and weaponry devices. In this way, better Air Force systems will be the long-range result.

Initially, Dr. Ross proposed to attack the problem by doing slow- to-intermediate strain rate studies using conventional property test methods. An in-depth literature search was also included in the initial task. In this expanded effort, Dr. Ross proposes to include analyses of plate stiffness with added stringer or rib stiffeners for a controlled response of panels between essentially fixed boundaries (bulkheads or forming rings).

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0006, QUALITY ASSURANCE PROCEDURES FOR COMPLEX MICROCIRCUITS

D. OLTMAN, Harris Intertype Corporation, *Melbourne, Florida* (DF736640; F30602-76-C-0328)

Evaluation of existing microcircuit quality assurance procedures to determine their effectiveness for screening complex microcircuits. The establishment and implementation of more meaningful and economical screens for complex microcircuits and the evolution of effective techniques for lot conformance testing of low-volume parts will result from this work. This effort will also attempt to establish the risk associated with relaxing, eliminating or replacing certain screening requirements in complex device procurements, where complexity and technology trends make compliance even more difficult and expensive.

Existing precap visual criteria of MIL-STD-883, which have become difficult or impractical to apply on complex and multilevel metallization devices, will be evaluated to determine what criteria could be inspected by using alternate methods of testing, i.e., thermal cycling, burn-in, special electrical testing or other unique screening techniques. The apparent problem with the existing visual is in metallization contact area, oxide and diffusion faults, alignment and missing or scratched conductors. It is proposed to initiate a study to cover three major areas: (1) bipolar MSI/LSI (60 gates or more), (2) MOS memories, (3) large hybrid arrays. These efforts will investigate the effectiveness of alternate non-visual screening methods including the following either as individual or combined screens for detecting and eliminating anomalies that are normally rejected in visual inspection: (1) thermal cycling, (2) burn-in, (3) electrical testing. The relative effectiveness of the alternative screens will be evaluated separately and in combinations and compared to the results when visual screens are applied in whatever manner is possible for complex devices.

ADDENDA: Supporting agency address is: Rome Air Development Center RBR, Griffiss AFB, N.Y. 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0007, LOW-COST PLASTIC ACTUATOR PROCESS DEVELOPMENT

J.R. HICKEY, Martin Marietta Corporation, *Orlando, Florida* 32805 (DF137220; F33615-76-C-3086)

Under contract F33615-74-C-3013, a low-cost molded plastic missile/RPV surface control actuator was successfully developed. Cost analysis showed a potential cost savings of over 33 percent using plastic parts. During the course of the program, a problem was recognized in that test samples of the hydraulic cylinder cases failed at diverse pressures ranging from 2/3 to 2 1/2 times operating pressure. The varying strengths appeared to be a function of the processing variables. The objective of this effort is to develop processes and procedures for compression molding hydraulic cylinder cases to produce a consistent high yield of low-cost, high-strength usable parts.

A minimum of 50 cylinder cases will be molded and tested. The length of glass fibers, the molding process and procedures including the use of preforms will be varied systematically in fabricating the test samples to establish the optimum procedures for producing low-cost, high-strength parts.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FGL, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0008, THE EFFECT OF ATMOSPHERIC PARTICULATE MATTER ON THE PROPAGATION OF A LASER BEAM 14372-GS

P. CHYLEK, Purdue University, Purdue Research Foundation, *Lafayette, Indiana* 47907 (DA0F8903; DAAG29 77 G0049)

To investigate the effects of nonsphericity of aerosols on the propagation of both visible and infrared laser beams through the atmosphere containing dust particles. Relevance - more precise definition of the scattering effects on nonsperical aerosols on laser propagation through the atmosphere will be applicable to the high-energy laser test experiments, the non-line-of-sight optical communications program, investigations of system performance of night vision sensor systems, the design and operation of terminal homing systems, and to laser remote sensing systems.

Calculate light scattered and absorbed by atmospheric dust assuming (1) spherical particles and using MIE theory, and (2) nonspherical particles and using an approximation method based on the assumption that surface waves are present in scattering by spherical particles and absent in scattering by irregular particles.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, N.C. 27709

SUPPORTED BY U.S. Dept. of Defense - Army

4.0009, DETERMINATION OF LOSSES IN T-BURNER WITH CIRCUMFERENTIAL SLOTTED VENT

J.R. OSBORN, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (DF046380; AF-AFOSR-3140-77)

AF function - the T-burner is recognized as a generally reliable and convenient tool for the study of combustion instability in rocket motors. Deficiency - a controversy exists as to whether the

T-burner vent results in a net gain or loss in acoustic energy through it. The resolution of this controversy is fundamental to the evaluation of T- burner results. Objective - this effort will provide an improved analysis of the vent with experimental verification of the new model. How work contributes - more reliable prediction of rocket motor combustion stability will be possible.

The analysis will assume axisymmetric viscous flow in the burner with viscosity effects included in the corner turning processes. Acoustic interactions will be examined in relation to inviscid but vortical motions in the vent corner. Subsonic flows are considered which include Mach number induced nonlinearities. The experimental studies will involve a cold-gas T-burner having a slotted vent. Hot flow results will be available for comparison based on experiments at AFRPL. Several vent corner shapes of interest may be considered.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0010, ROCKET CHARGING STUDY

H.A. COHEN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249280)

AF function - communication satellites in geosynchronous orbit. Deficiency - electrical charging of satellites by ambient particles causing anomalous switching of electronic circuitry. Objective - development, testing and use of charge ejection systems to duplicate, prevent, or control satellite charging. How research contributes - by the development, testing and use on space vehicles of charge ejection systems, charging of satellite surfaces can be controlled for predetermined periods, obtaining either large or small potential differences with respect to ambient plasma.

A sounding rocket payload is being prepared for flight. This payload will have the dual purpose of obtaining a relationship between the charge ejected from a space vehicle, ambient parameters, and the resultant charge on the vehicle surface, and the testing of the satellite positive-ion beam system to be used on the SCATHA satellite.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0011, SPACECRAFT CHARGING NUMERICAL THEORY

P.L. ROTHWELL, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249040)

AF function - AF satellite systems operate at synchronous altitudes where charging can occur due to natural causes and may give rise to effects deleterious to the systems. Deficiency - the plasma physics interactions responsible for spacecraft charging are not well understood at present and it is necessary to develop appropriate models in order to obtain this understanding. Objective - to develop descriptions of the plasma and energetic particle environment surrounding a spacecraft at high altitude and its spatial and temporal behavior. How research contributes - numerical simulation of plasmas techniques are employed to model the plasma physics interactions of the ambient environment with the spacecraft. Understanding of the interaction and the ability to model sheaths, beams, secondary effects and instabilities will contribute vitally to the solution of the spacecraft charging problem.

A spherically symmetric code has been developed employing a numerical simulation model. The motion of several thousand particles in the field of the spacecraft and their self-consistent field is followed. The code includes the quiet start technique, cloud in cell particle treatment, and distribution function smoothing. Photosheath effects are treated, as well as secondary electrons and electron and ion guns. Quantities calculated are the satellite potential, the sheath structure and the current to the satellite.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0012, SCALABLE NANOSECOND CO2 LASER TECHNOLOGY

M. SIRCHIS, Avco Corporation, *Everett, Massachusetts* 02149 (E(11-1)-4055)

A major element in the ERDA thermonuclear fusion research program is the availability of scalable nanosecond carbon dioxide laser amplifiers. The key technical question for device scaling and for maximum performance of MOPA (master oscillator power amplifier) chains under design and construction is the development of scalable gain isolation. To advance the ERDA carbon dioxide laser development program, aimed towards developing scalable gain isolation in nanosecond CO2 laser amplifiers, using flowing saturable absorber media and multi- line amplification. The program, furthermore, is in every way commensurate with supporting the general criteria established for the LASL high-energy CO2 laser facility.

The technology development under this program will be: 1) compatible with any high-pressure nanosecond CO2 laser; 2) compatible with optimum technical and engineering configurations and large-scale amplifiers and optics; 3) independent of pulse duration and inversion densities.

To achieve the goal of scalable gain isolation based upon flowing saturable absorbers and multi-line propagation and amplification, the following efforts must be pursued: 1) Investigation of saturable absorber candidates. 2) Flow aerodynamics. 3) Nondispersive multi- line propagation and amplification. 4) Ratification of the flowing saturable absorber concept on full-scale devices.

The implementation of these efforts in a comprehensive manner will significantly benefit the ERDA CO2 laser program.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - L.F.D.

4.0013, RESEARCH ON THE INVERSE PROBLEM OF SCATTERING

H.E. MOSES, Univ. of Lowell, Graduate School, *Lowell, Massachusetts* 01854 (DF046160; AF-AFOSR-3169-77)

AF function - radar detection of aerospace vehicles. Opportunity - existing mathematical techniques promise improvements in the design and use of radar. Objective - inverse scattering techniques which should be applicable to certain microwave filter designs. How work contributes - improved techniques for inverse scattering should produce new design and analysis techniques.

Inverse scattering theory such as the Gelfand-Levitan approach has resisted application for many years due to the lack of work in areas related to range, domain, null space and their approximate analogues relevant to measurement and modeling errors. The example of design of a microwave filter as a finite-length transmission line will be investigated. The range of reflection and transmission coefficient attainable and the sensitivity to modeling error will be attacked both from the small perturbation and the variational principle point of view. Additional work on three-dimensional problems, nonlinear wave equations solvable by inverse scattering transform, and ionospheric measurement will be considered, time permitting.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0014, NEW LASERS BASED ON COMPLEXES OF TRANSITION METALS

A. LEMPICKI, General Tel. & Elec. Corp., *Waltham, Massachusetts* 02154 (DF046290; F49620-77-C-0015)

AF function - this program is concerned with the development of an entirely new class of visible lasers which should represent a significant advance in coherent light sources. In Air Force applications, the ability to rapidly tune the wavelength of short, high- energy pulses would be a distinct advantage in many countermeasure, ranging and guidance applications. Deficiency - for these kind of avionics applications, ordinary dye lasers often fall short of the required energy per pulse and average power. Objective - the objective of this work is to develop materials and technology which will result in tunable systems having many of the advantages and properties of dye lasers but which would have superior energy storage capability, offer the possibility of q-

switching, and which could be pumped with much higher energy light sources without the extremely short flash duration requirement of dyes. Contributions - some of the complexes of transition metals emit light with lifetimes, line width and extinction coefficients which are intermediate between the dyes and the rare-earth liquid lasers. These complexes bring a new dimension to optically pumped lasers, whether solid or liquid.

The single property which is most significant for the operation of dye lasers is the short radiative lifetime (in the nanosecond regime) of the fluorescence process. It is this short lifetime which is responsible for the high gain but which at the same time represents a limitation where energy storage is important. The key problem is to find materials with longer radiative lifetimes, but line widths and yields comparable to dyes. Materials exhibiting strong phosphorescence are of limited interest due to the combined effect of broad line width and long lifetime on the laser threshold. The complexes of transition metals offer an alternative which is the thrust of this research. In particular, the porphyrins of transition metals are promising materials.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0015, SIMPLIFIED INERTIAL GUIDANCE DEMONSTRATION (SIGD)

J.P. LAUGHLIN, Vought Corporation, *Utica, Michigan* 48077 (DA0F1235; DAAH01-76-C-0619)

The technical objective is to design, manufacture, test and deliver three flight demonstration missile airframes with pneumatic controls to be utilized as flight demonstration vehicles to test low-cost strapdown guidance techniques.

The airframe will use solid propellant motors manufactured during the Greener Pastures Program, empty lance E-11 warheads for the nose section, and modified midsection for guidance system mounting. Aft mounted pneumatic controls using four elevons for control will be developed. Midship wings and aft tail/elevon surfaces are being designed based on wind-tunnel tests. The government will integrate a ring laser gyro strapdown inertial guidance system into the airframe for feasibility demonstration flight testing.

ADDENDA: Supporting agency address is: MICOM Guidance and Control Dir., Missile RD & E Lab., Redstone Arsenal, AL 35809

SUPPORTED BY U.S. Dept. of Defense - Army

4.0016, RADIATION EFFECTS IN CMOS/SOS DEVICES (Z99QAXTA007 DNA)

B.S. ROYCE, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DA0F5754; DAAG39-76-C-0070)

To determine the physical mechanisms responsible for the radiation- induced back channel leakage in CMOS/SOS integrated circuits.

To use thermal excitation and photodepopulation to determine the energy level and density of radiation-induced trapped charges at the sapphire/Si interface.

ADDENDA: Supporting agency address is: DARCOM Harry Diamond Lab., DRXDO-RBG, 2800 Powder Mill Road, Adelphi, MD 20783

SUPPORTED BY U.S. Dept. of Defense - Army

4.0017, PROPOSAL TO VERIFY ROCKET EXHAUST PLUME EFFECT SIMULATION TECHNIQUES 13797-E

C.F. REID, Calspan Corporation, *Buffalo, New York* 14221 (DA0F8934; DAAG29 77 C 0008)

To investigate the validity of a cold jet simulation of rocket exhaust plume effects by direct experimental comparison between hot and cold jet base and afterbody pressures and between calculated pressures based on cold jet modeling and measured hot jet pressures. Relevance - the research is directly relevant to the understanding of plume effects on missile aerodynamics which is important because of the possible adverse effects of plumes and because of the potential for improving the accuracy of free rockets. Such technology is one of the principal thrusts of the Aeroballistics Directorate at MICOM.

Base and afterbody pressure measurements and Schlieren photographs of the plume from a solid-fuel rocket engine will be made and used for comparison with an analytical model based on cold jet simulation of the hot jet and with cold jet experimental measurements of similar quantities.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, N.C. 27709

SUPPORTED BY U.S. Dept. of Defense - Army

4.0018, PREPARATION AND PROPERTIES OF ALTERNATING LAYER SUPERCONDUCTORS

D.G. AST, Cornell University, School of Engineering, *Ithaca, New York* 14850 (DF037890; F44620-74-C-0019)

Advances in Air Force electromagnetic materials and devices and power generation and distribution depend upon new and improved superconducting materials. The performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators and induction energy storage systems could be significantly improved if the upper critical field, the current-carrying capacity and the critical transition temperature of the superconducting material could be enhanced. In addition, ac power distribution losses and mechanical breakdown of the superconductor could be reduced. This research investigates a new class of superconducting materials - a composite which consists of thousands of very thin alternating layers prepared by vapor deposition techniques. The objective is to prepare multilayer thin film superconductors and investigate such specific structural properties as chemical composition, metallurgical phase, microstructure and crystallinity, in order to develop a continuous process for fabrication. Physical properties such as the superconducting transition temperature, critical current, upper critical field decoupling of the layers and ac losses are also being investigated. Structural and physical properties are being correlated in order to improve existing or develop new superconductors for promising applications in low-temperature electromagnetic devices.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0019, ANALYSIS AND NUMERICAL SOLUTION OF THREE-DIMENSIONAL VISCOUS FLOW PROBLEMS

K.N. GHIA, Univ. of Cincinnati, School of Engineering, *Cincinnati, Ohio* 45221 (DF046990; AF-AFOSR-3191-77)

AF function - advanced aerospace vehicles and airbreathing propulsion systems. Opportunity - improve our understanding of three- dimensional internal viscous flows. Objective - develop a finite- difference numerical technique suitable for solving three-dimensional internal viscous flow problems involving cross flow separation. How work contributes - provides a method which could be used to study flow through inlets with longitudinal and transverse curvature effects.

A finite-difference numerical technique will be developed using the parabolized Navier-Stokes equations. For flows involving complex geometries, the method will employ surface-oriented coordinates. An optimized alternating directional implicit scheme will be employed in order to lead to an efficient solution technique.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0020, HIGH-SPEED INSTRUMENTATION FOR GENERATOR TEST FACILITY

E.J. CAPUTO, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458970)

Complete the AFAPL generator test facility by providing a data acquisition and control system with the following capabilities: (1) sufficient acquisition speed to characterize aircraft elec-

trical system transient performance, (2) storage of all performance related test data, (3) short time playback and analysis capability, (4) complete automation, and (5) engine start simulation.

Design system and procure and integrate all necessary components to accomplish objective. System will be composed at a MODCOMP II computer, a high-density digital tape drive, 18 10-microsecond conversion a/d converters, and necessary interfacing and control circuitry. The MODCOMP II will be a satellite in the AFAPL computer network.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory POP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0021, F-111 WIND-TUNNEL MODEL REWORK

A.B. RILEY, General Dynamics Corporation, *Fort Worth, Texas* 76101 (DF640510; F04606-75-D-0114)

(1) The modifications to the F-111 model will support store separation studies. (2) The use of the F-111 wind-tunnel model will allow the determination of safe store separation envelopes before full- scale flight tests. (3) The goal of this task is to modify the present model so that more extensive wind-tunnel data can be obtained. (4) The data that will be gained with the aid of the modified model will provide increased accuracy in predicting store separation characteristics.

The addition of a weapon bay, internal balance, and aircraft empennage will allow all necessary testing to be conducted. These modifications were planned for during the construction of the original model.

ADDENDA: Supporting agency address is: AF Armament Laboratory DLJC, Eglin AFB, FL 32542

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0022, MORPHOLOGY OF DESIGN OF AEROSPACE SYSTEMS WITH INCLUSION OF HUMAN RESOURCE FACTORS

B. OSTROFSKY, Univ. of Houston, School of Engineering, *Houston, Texas* 77004 (DF046470; AF-AFOSR-3148-77)

AF function - the systems engineering/systems management procedures developed by the Air Force during the 1960's identified the philosophy and the details and implementation for Air Force systems. This documentation identified reporting details for each activity during the system life cycle and, while it left the designer free to improvise, it constrained his activities to definable and reportable categories. An improved rationale for the design of technological systems is required. Deficiency - the effects of changes or retrofits in the long-term development and acquisition of expensive, advanced technological systems must be anticipated more accurately to help eliminate significant cost overruns. Objective - the research proposed will define a decision structure required to use resources optimally in attempting to meet design objectives. How research contributes - the research resulting from this effort is intended to clarify the decision structure and methodology for the design of high-technology, large-scale Air Force systems with emphasis on integration of human resources factors and metrics.

A human factors and metric study will review recent developments in design morphology, identify relevant human factors information, clarify subjective and objective design inputs, and define areas for quantification in the evaluation of criteria. An analysis of information into a multivariate criterion function will structure an input-output matrix for each phase of an aerospace system life cycle, validate information obtained regarding criteria definition, identify aerospace system criteria conceptually, and establish the metrics for allowing assessment of the relative importance of criteria and their interactions. Clarification of methodology will define the design parameters, submodels and models of criteria, taking advantage of recent developments to structure a criterion function. Testing this function will be accomplished by using sample data.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NL, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0023, THREE-DIMENSIONAL DISTURBANCES IN HIGH-SPEED BOUNDARY LAYER FLOWS

G.R. INGER, Virginia Poly. Inst. & St. U., School of Engineering, *Blacksburg, Virginia* 24061 (DF045690; F49620-76-C-0013)

AF function - advanced aerospace vehicles. Opportunity - provide better understanding of the mechanism of flow separation/reattachment and three-dimensional effects on pressure distribution, skin friction and heat transfer effects. Objective - investigate the twin problems of flow separation/reattachment and three-dimensional effects in high-speed boundary layer flows along two-dimensional and axisymmetric bodies. How work contributes - better understanding of this phenomenon will be directly applicable to the design of future aerospace vehicles.

A theoretical study will be established with the objective of developing a fundamentally sound yet engineering-oriented analytical approach from which skin friction, heat transfer, and wave drag can be predicted as function of Mach and Reynolds number, wall temperature ratio and vortex parameters.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, NAVY ENVIRONMENT - INFRARED ATMOSPHERIC PROFILING

C.R. CLAYSMITH, General Dynamics Corporation, *San Diego, California* 92138 (DN575314; N00014-75-C-0940)

Operation of Navy aircraft near the sea surface and naval combatants on the sea surface require accurate and timely environmental information which will allow the operational commander to fully assess his options. The paucity of available environmental information over the oceans compounds the Navy's problem of accurately forecasting atmospheric conditions. An infrared profiler will provide a reliable, easily maintained, automatic, remote sensor for the measurement of water vapor and temperature in the vertical from the surface up to 7 km.

The Mullard detector failed, causing the return of RIAPS I to the contractor from Pacific Missile Range (PMR). A Barnes detector was installed. RIAPS II has not been completed and calibrated due to nondelivery of replacement parts. Recognizing the applicability of RIAPS to the EO/MET program, utilization approach changes with this action. The RIAPS instrument will be operated for the next year by the Geophysics Division, PMR, supported by the contractor. The support will include profile analysis as well as instrumentation calibration and maintenance.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0002, NEAR-SHORE METEOROLOGY

R. CHARNELL, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (R7120848)

PROJECT OBJECTIVE: As a part of the OCSEAP program to obtain a descriptive picture of the extent, magnitude, frequency and distribution of near-shore meteorological processes which contribute to the circulation and mixing of coastal waters.

CURRENT YEAR PLAN: A mesoscale atmospheric numerical model will be used to study the near-shore wind field in selected areas along the Alaskan coast. Various typical synoptic situations will be used to derive the model. In addition, several remote weather stations will be deployed along the coast between Icy and Yakutat Bays to supplement available data. Also, an intensive two-week field experiment will be conducted in this area in order to obtain a sufficiently complete set of data against which to verify the model. Surface weather data around Bristol Bay and NOAA-4 satellite photographs will be used to study the effects of the Aleutian Chain as a barrier to flow from the Bering Sea into the western Gulf area. In particular, the mesoscale flow field around Kodiak Island will be investigated.

PROGRESS REPORT: Preliminary studies have been made of the wind field and boundary layer characteristics in the area off of Yakutat. Data from three different time periods were collected. These data were collected primarily by launching radiosondes from a ship. During the year a sonde package was developed which will be used with a balloon or kite to obtain repeated profile measurements of boundary layer parameters in any selected area. Also, a number of mesoscale numerical models were considered and one developed by Ronald Lavoie for the Great Lakes project was chosen for use along the Alaskan coast.

SUPPORTED BY U.S. Dept. of Interior - Bu. Land Mgmt.

5.0003, THE FORMATION AND DISTRIBUTION OF WHITECAPS PRODUCED BY BREAKING WAVES ON THE OCEAN SURFACE

R.L. SNYDER, Nova University, Physical Oceanographic Lab., *Dania, Florida* 33004 (OCE76-10739 A01)

This project will study the formation and properties of whitecaps (foam) produced by the spontaneous breaking of surface waves. Photographs of the formation and growth of whitecaps have been collected for a variety of wind conditions at an instrumented tripod in the Bight of Abaco near Grand Bahama Island. The photographs will be scanned to determine the size, growth, and frequency of occurrence of the whitecaps. These properties will then be related to wind speed and direction and wave speed and direction. Attempts will be made to determine the criteria governing the formation of whitecaps. Understanding whitecapping is very important (a) to understanding energy dissipation by the breaking of surface waves, and (b) to interpreting data from remote sensing instruments mounted on aircraft or satellites. For example, instruments employing microwave-scattering techniques are very sensitive to the percentage of the sea surface containing foam. This project will give the desired high priority to analyzing the whitecap data.

SUPPORTED BY U.S. Natl. Science Foundation

5.0004, DOPPLER RADAR STUDIES OF STRATIFORM PRECIPITATION

R.C. SRIVASTAVA, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (ATM77-01254)

Studies of snow storms and melting band rain using a vertically pointing and scanning S-band Doppler radar are proposed. The emphasis will be on the study of the velocity distribution on different scales and their interactions. In melting band rain, the changes of particle fall velocity spectrum during melting will also be studied.

A multiple Doppler radar study of winter frontal and lake effect storms will be performed using the above radar, the Chicago, Illinois, CHILL radar and the NCAR C-band Doppler radar. The University of Chicago's cloud physics airplane will participate and sample the clouds.

SUPPORTED BY U.S. Natl. Science Foundation

5.0005, PARTICLES AND CURRENTS IN THE GEOMAGNETIC FIELD

D.B. BEARD, Univ. of Kansas, School of Liberal Arts & Sci., *Lawrence, Kansas* 66045 (ATM76-23448)

This grant continues the development of a self-consistent theory of the earth's magnetotail. The investigators will complete the calculation of the magnetic field throughout the tail from integrating over all currents in a self-consistent way (The currents are derived from the successive approximations of the magnetic field). Secondly, they will examine the entrance of plasma into the tail from the magnetosheath as a result of particle drift. In addition satellite data will be analyzed for plasma near the magnetopause and compared with the theoretical results. Thirdly, they will extend the magnetotail calculations towards the earth expecting to derive the abrupt near-earth edge of the magnetotail current system where the earth's dipole field inhibits the tail sheet current. The overall aim of this work is to further our understanding of the magnetic field of the earth and the way in which solar particles penetrate that field.

SUPPORTED BY U.S. Natl. Science Foundation

5.0006, MODIFY DIGISONDE EQUIPMENT

K. BIBLE, Univ. of Lowell, Res. Foundatton, *Lowell, Massachusetts* 01854 (DF248470; F19628-77-C-0024)

AF function - communications and detection. Deficiency - prediction and real time specification of the arctic ionosphere. Objective -modify existing ionospheric digital sounding system at AFCRL Goose Bay Ionospheric Observatory and the existing airborne digisonde to improve equipment performance for routine operations and insure compatibility between digisonde systems. How research contributes - provides further progress in digital sounding techniques through the modification of ionospheric sounding equipment at the AFCRL Goose Bay Ionospheric Observatory and the NKC-135 research aircraft. The contractual efforts also provide maintenance support and consultation on complex systems. The Goose Bay ionospheric data are essential in the laboratory's research efforts in providing HF systems a model of the arctic ionosphere.

Modify the Goose Bay Observatory digisonde to provide Doppler line information. Develop improved software techniques to analyze, process and display the modified digital ionogram data. Develop methods for noise reduction and data compression for digital ionograms. Incorporate improvements in Goose Bay Observatory and Airborne Observatory. Provide consultation on modifications of aircraft and Goose Bay Observatory digital ionosondes, to meet changing project experimental needs. Reduce and analyze digital ionogram data.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0007, THE ROLE OF SOLAR ULTRAVIOLET RADIATION IN THE FORMATION OF HYDROXYL RADICALS IN THE TROPOSPHERE

F.B. SELLERS, Panametrics Incorporated, *Waltham, Massachusetts* 02154 (ENV76-23902)

The reaction of hydroxyl radical with various trace gases has been hypothesized as fundamental to complete understanding of tropospheric chemistry. For example, the atmospheric concentrations, lifetimes and distributions of methane, carbon monoxide and sulfur dioxide are believed to be largely controlled by the hydroxyl radical. The dominant source of hydroxyl radical in the troposphere is photolysis of ozone by solar ultraviolet radiation to produce atomic oxygen, which then reacts with water to produce the radical. Because ultraviolet flux is highly variable in the troposphere, it is of fundamental importance that it be measured simultaneously with the various important constituents.

This program is designed to provide accurate airborne ultraviolet flux measurements in the 280-400 nm wavelength region. The flux measurements will be made from the National Center for Atmospheric Research aircraft simultaneously with the chemical and meteorological measurements of the NSF supported program entitled 'Global Atmospheric Measurements Experiment on Tropospheric Aerosols and Gases' (GAMETAG). The objective of this program is to provide the GAMETAG project with adequate radiation information to define the chemical role of the hydroxyl radical in the troposphere.

SUPPORTED BY U.S. Natl. Science Foundation

5.0008, FOREST RESOURCE MANAGEMENT APPLICATIONS OF MEDIUM- TO HIGH-ALTITUDE COLOR INFRARED AERIAL PHOTOGRAPHY

M.P. MEYER, Univ. of Minnesota, Agric. Experiment Station, *St. Paul, Minnesota* 55101 (0064373; MIN-19-050)

OBJECTIVE: Improve the efficiency of forest land managers through the determination of the best type and the cost-effectiveness of medium- and high-altitude infrared color aerial photography for forest resource surveys and forest land management.

APPROACH: A forested area in northern Minnesota will be photographed using standard forestry aerial photography and various types of smaller scale color infrared aerial photography. Selected forest survey and forest management information needs which can be determined from aerial photographs will be interpreted by locally experienced trained professional forest aerial photo interpreters. The results of the interpretations will be analyzed by statistical means as well as interpreter reaction. At

the same time, data on the costs of the two types of aerial photography will be determined. A benefit-cost approach will be used to determine the optimum type of photography for forest survey and management purposes. In addition to the project interpreters, all possible local, on-the-ground, land managers will be given copies of the photography to evaluate in their own terms.

PROGRESS: Forestry field user-cooperators, both in public agencies and forest industry, continued their evaluation of the following experimental types of forest aerial photography located in various portions of Itasca, Mahnomen and Becker counties: summer B&W infrared photography at scales of 1:15,840, 1:24,000 and 1:31,680; and summer color infrared photography at a scale of 1:31,680. Following a two-year delay 1:80,000 scale quad-centered color infrared photography was flown of all of Itasca County, Minnesota, with a 6-inch 9 X 9 format metric camera and cooperator-user evaluation was initiated. A test of the applicability of medium-scale 35mm aerial photography to monitor construction and vegetation ingrowth on power transmission line right- of-ways through forest land was initiated.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0009, THE DYNAMICS OF SMALL CUMULI
J.W. TELFORD, Univ. of Nevada System, Desert Research Institute, *Reno, Nevada* 89507 (ATM76-23361)

This proposal describes the recent development in cumulus cloud dynamics arising from the author's work with airborne measurements of airmotion near cumulus clouds. The departures from the previous models are discussed in detail and the conceptual basis of the new ideas are laid out for consideration. Theoretical work using concepts derived from the interpretation of past measurements seems to offer the best interpretation of the facts known to date. The role of airmotion measurements in several crucial tests are discussed and it is proposed that such measurements can be made with available equipment. The proposal offers the use of the airborne measurement equipment developed at the Desert Research Institute (DRI), using the Litton LN15D inertial platform and the DRI aircraft, to obtain the necessary measurement data.

If this theory is confirmed it will offer a major new insight into the dynamics of small cumuli.

SUPPORTED BY U.S. Natl. Science Foundation

5.0010, ATMOSPHERIC ELECTRICITY
B. VONNEGUT, State University of New York, School of Arts & Sciences, *Albany, New York* 12222 (ATM76-00908 A01)

This research involves investigation of several topics related to atmospheric electricity and cloud physics. These include: (1) Atmospheric aerosol with particular emphasis upon metastable particles which may be either crystalline or amorphous. The difference in electrical behavior between spherical and non-spherical particles will also be investigated. (2) Fair-weather atmospheric electricity - this involves investigations of the natural large sources of charge, such as volcanoes, large waterfalls and dust storms, and whether these sources are producing measurable effects on electrification of clouds growing downwind. (3) Thunderstorm electricity - this investigation will initiate a program of time-lapse motion picture photography of thunderstorms taken from high-altitude balloons at night. Such observations will determine the correlation between the convective motions of the cloud and the occurrence of lightning. (4) Tornado- producing storms - this investigation will initiate a program to characterize the lightning in tornadic storms by still and motion picture photography. Cameras will be equipped with spectroscopic ratings and a novel photo-electric optical recording system to record the intensity and frequency of the discharges both at night and during the day.

SUPPORTED BY U.S. Natl. Science Foundation

5.0011, ROCKET AND SATELLITE MEASUREMENTS OF ELECTROSTATIC WAVES DURING THE INTERNATIONAL MAGNETOSPHERIC STUDY (IMS)
M.C. KELLEY, Cornell University, School of Engineering, *Ithaca, New York* 14850 (ATM75-04269 A01)

This supplement to NSF grant ATM75-04269 will permit Dr. M. Kelley, Cornell University, to organize a study group to test feasibility of a new type of ionospheric experiment. This includes Dr. Paul Bernhardt, Stanford University, Dr. Dave Andersen, NOAA, and Dr. Gerhard Haerendel of the Max Planck Institute in a computational exercise on 'equatorial spread F' (rising bubbles of rarefied ionization). The plan is to inject by means of a rocket up to 30 kgm of water into the ionosphere. This will deplete the ionosphere stimulating artificial 'equatorial spread F.' This grant will enable the feasibility of such an experiment to be tested.

SUPPORTED BY U.S. Natl. Science Foundation

5.0012, OGO VI HIGH-RESOLUTION ION TRAP STUDIES OF IONOSPHERIC IRREGULARITIES
J.P. MCCLURE, Univ. of Texas, Center For Space Sciences, *Richardson, Texas* 75082 (ATM76-17351)

This grant funds a study of ionospheric irregularities using two recently acquired sets of unique data. These data are from the Jicamarca Radio Observatory's new multi-beam antenna and from the new high-resolution ion trap experiments on three Atmosphere Explorer satellites. These data will be used for detailed studies of the physical structure and motions of irregularities in the ionosphere.

SUPPORTED BY U.S. Natl. Science Foundation

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, RESEARCH OF VISUAL PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION
R.W. WILEY, U.S. Army, Biooptics Division, *Ozark, Alabama* 36360 (DA0B6891)

To provide information about the visual sensory modality relating to capability of the human visual system and the impact of military equipment, environmental and operational influences on visual performance and integrity.

The approach will include psychophysical, electrophysiological, and other objective techniques to evaluate human visual performance with quantitative measures.

ADDENDA: Supporting agency address is: MDRDC Aeromedical Research Laboratory, Ft. Rucker, AL 36362

SUPPORTED BY U.S. Dept. of Defense - Army

6.0002, VISUAL CUE UTILIZATION DURING FLIGHT
W.D. LEMASTER, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223260)

To determine the extent to which available visual cues are utilized by pilots in the performance of flight maneuvers learned in undergraduate pilot training (UPT), to determine the methods of perception (fixation or peripheral) of visual cues, and to investigate eye movements by expert pilots during landing and other maneuvers.

The initial data for this study were collected by instructor pilots wearing the helmet-mounted NAC eye mark recorder in T-37 aircraft flights under WU 1123-01-10. Assessment and evaluation of the filmed and videotaped eye movement data will determine whether or not consistent patterns of visual cue utilization occur. If such patterns can be detected, they will form the basis for the development of improved training methods for UPT.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory, Ft. Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0003, HUMAN OPERATOR MODELS RESEARCH
A.V. PHATAK, Systems Control Incorporated, *Palo Alto, California* 94306 (DF316390; F33615-75-C-5070)

The objective of this research effort is to identify the analysis structure and the parameters of an optimal control model to validate this method of analysis for an air-to-ground RPV strike

mission. This approach will be used to analyze the air-to-ground weapon delivery task with a general-purpose bomb and a depressed reticle fixed sight superimposed over the video from a television camera fixed on a remotely piloted vehicle. The analysis procedure is partitioned into three segments: (1) target acquisition to initiation of attack point, (2) initiation of attack to weapon release point, (3) weapon release to weapon impact point. The second segment is of primary interest in this effort.

RPV man-in-the-loop simulation data will be provided to the contractor to develop estimation algorithms to determine the nominal trajectory from this data and to validate the candidate trajectories generated with the estimation algorithms. The contractor shall form some candidate hypotheses to generate trajectories used by human operators of RPVs. These trajectories shall be compatible with the optimal control model of the human operator. The contractor shall expand the structure of the model to include display degradation which can be used for a candidate analysis model on an RPV system with a jammed video air-to-ground link.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0004, IN-FLIGHT BIOMEDICAL ASSESSMENT OF NAVAL AIRCREW MEMBERS

D.H. REID, U.S. Navy, Crew Systems Branch, *Port Hueneme, California* 93042 (DN777291)

To acquire multi-parameter physiological and engineering data from aircrewmen flying high-performance naval aircraft via state-of-the-art bio-instrumentation techniques under a variety of normal in-flight conditions including air combat maneuvering (ACM) and missile launch engagement; to conduct metabolic workload studies of aircrew personnel evaluating new tactical procedures, weapons systems hardware or life support equipment; to acquire a data base of physiological responses to operationally realistic in-flight environments such as ACM and missile launchings; to employ meaningful parameters for the specific flight environment; to acquire baseline data from aircrew subjects; to develop potential criteria for assessing aircrew fitness and/or selection, and to perform physiological assessment of combined flight stress of naval aircrewmen under operationally realistic conditions.

To utilize recently developed bio-instrumentation systems for acquiring pertinent biomedical and engineering parameters continuously throughout selected high-performance aircraft flight profiles. The data acquisition systems utilized will have four-hour recording capability on cassette tape recorder and will obtain seven channels of pertinent data including ECG, O2 concentration inhaled air, O2 concentration exhaled air, O2 consumption, respiratory min. volume, plus or minus GZ, voice for event annotation, IRIG 'b' time code. Capabilities of Pacific Missile Test Center sea-test range will be exploited in acquiring operationally realistic data from combat experienced aviators. Self- control study. Baseline data will be collected under laboratory conditions.

ADDENDA: Supporting agency address is: Naval Medical Research and Development Command, Code 42, NNMC, Bethesda, MD 20014

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0005, EVALUATION OF LIGHTWEIGHT AIRCREW HELMET

J.A. VANHAASTERT, Sierra Engineering Company, *Sierra Madre, California* 91024 (DF320300; F33615-76-C-0600)

Tactical Air Command has an immediate requirement for an improved helmet for aircrews of high-performance aircraft, as stated in TAC ROC 16-72A, Aircrew Protective Headgear. Current headgear increases aircrew fatigue and significantly impacts on aircrew's ability to perform in aerospace environments of new-generation aircraft. The objective of this effort is to evaluate a new helmet design concept and its impact on aircrew safety and performance, with a view toward providing guidance for operational test and evaluation hardware at the earliest possible date.

The contractor will fabricate replicates of a new helmet which incorporates unique design features intended to result in weight reduction, reduction of aerodynamic lift upon ejection, improve peripheral vision, minimum bulk, and optimal fit and comfort. He will subject the helmet to a test program including evaluation of impact protection, retention under windblast, and acoustics attenuation. The program will also provide for USAFSAM evaluation of oxygen equipment compatbility, stability during acceleration, visual fields under fixed and dynamic conditions, and other factors. Following completion of initial evaluations, the contractor will incorporate design improvements for laboratory validation and limited field trials which are to result in a final design concept. The end products of this effort will be comprehensive technical data and reports for ultimate use as biomedical guidance for development and procurement specifications.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine BR, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0006, AUTOMATED ADAPTIVE TRAINING FOR THE LANDING SIGNAL OFFICER

D.A. NORMAN, U.S. Navy, Human Factors Laboratory, *Orlando, Florida* 32813 (DN794013)

To develop, implement and test, in the context of an automated trainer, techniques for training which will improve the training progress of the landing signal officer (LSO) and thereby reduce cost in manpower and equipment, through development of models of the LSO task and pilot-LSO interaction. Use of modeling techniques can increase training effectiveness by providing objective performance measurement and guidance in skill acquisition at any point in the training process.

The effort consists of: (1) identification of visual and auditory cues; (2) development of models of the visual scene, pilot response, and pilot-LSO interaction; (3) application of voice recognition, performance measurement, and automated adaptive training technologies; and (4) empirical test of effectiveness of the training system.

ADDENDA: Supporting agency address is: Naval Air Systems Command Research and Technology, Washington, D.C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0007, TASK LOAD AND OPERATOR ATTENTION CAPACITY IN TIME SHARING PERFORMANCE

D. GOPHER, Israel Inst. of Technology, *Haifa, Israel* (DF046760; AF-AFOSR-3131-77)

AF function - as the role of the pilot is shifting from a direct controller of aircraft functions to a monitor and decision maker in a complex, dynamic, and intelligent man-machine system, a requirement has emerged for the measurement of abilities that support this new role. Deficiency - the increasing complexity of flight missions combined with the growing sophistication of airborne systems and the concurrent increase in production and training costs have emphasized the need for improved techniques in the assessment of pilot attention capacity and task load. Objective - the research activity will follow three major lines: a) development of quantitative assessment and time sharing efficiency, b) training for time sharing, and c) development of software package, including feedback devices and adaptive techniques. How research contributes - improved techniques and prediction equations for the evaluation of task load and operator efficiency in time sharing situations will be utilized in system design and development.

It is proposed to incorporate major classes of tasks in a cross-matrix design that will examine the interrelation between the tasks and the appropriateness of the methodological approach in quantifying performance and manipulating demands.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NL, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0008, ADVANCED COMPONENT TECHNOLOGY

J.H. BRINDLE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321170)

This work unit will develop operator-centered display technology for AF real-time reconnaissance and weapon delivery functions. Display concepts will be formulated and prototype equipment developed to enhance man's visual ability to interface with various state-of-the-art and advanced development reconnaissance weapon delivery, teleoperator and simulation subsystems. These concepts involve visually coupled control/display devices (helmet-mounted sight/display), virtual image display techniques and holographic lens projection techniques. Consultation will be provided for further design, development, and deployment of systems based on these concepts. Efforts are coordinated with Tri-service Display Technology panel members, the Naval Air Systems Command, Naval Air Development Center, Army Night Vision Laboratory, Air Force Armament Laboratory, Aeronautical Systems Division, and the Air Force Office of Scientific Research. This effort supports AFSC development goals, TC-2, TC-4, TC-5, TC-7, and MS-4, PMDR P2033(5)/64708F/5973, Visual Coupling Aids, and TAC ROC 313-74, Slewable Electrooptical Reconnaissance Sensor.

Promising state-of-the-art technology in optics, electrooptics and electronics will be applied to develop and evolve operator display subsystems and concepts which enhance overall operator performance in target acquisition and weapon delivery tasks. During FY 77, design criteria and specifications will be defined for the interim and advanced helmet display components for the visually coupled airborne systems simulator (VCASS). Solid-state matrix-element image sensing and generating devices will be integrated with new techniques, including holographic diffraction optics, to project images to the operator's visual field. Development of variable resolution and color virtual image displays will be continued. Pseudo-stereo effects and image multiplexing will be demonstrated and their effects on target acquisition defined in the display/image metric laboratory. Variable transmission visor techniques will be addressed. Display techniques for multisensor information (forward-looking infrared, low-light-level TV, radar and laser sensors) will be evolved. This work unit, in part, encompasses work previously reported under work unit 7184-04-42, Display Concept Development.

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0009, BODY SIZE AND MASS OF AF PERSONNEL

C.E. CLAUSER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320940)

To describe body-size distributions of AF personnel for: (1) guiding the design, sizing, and procurement of personal-protective equipment and clothing and the layout of workstations, (2) establishing relationships between body size and injuries incurred upon ejection, and (3) developing human mass distribution and body-size criteria for the design of human analogues required to simulate the body's response to impact, ejection and windblast forces.

The anthropometric data base of USAF men and women required for guiding the design, sizing, and procurement of personal-protective equipment and clothing will be updated in FY 77 for establishing relationships between body-size and injuries incurred during the ejection sequence. In FYs 77 and 78, advantages will be taken of recently developed biostereometric techniques to determine for the first time mass distribution characteristics of a sufficient number of living human beings to be able to describe variability of these parameters in the USAF male population. Emphasis is placed upon developing procedures for improving the efficacy with which anthropometric data can be applied to the design of AF systems and equipment. This effort was formerly documented under work units 71840803 and 71840807.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0010, LIFE-CYCLE COST OF SIMULATED VS ACTUAL AVIONICS MAINTENANCE EQUIPMENT FOR THE F-16 TRAINING PROGRAM

F.T. EGGEMEIER, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF228260)

To compare the life-cycle cost of F-16 avionics intermediate-level training when conducted on simulated vs. actual aircraft and maintenance equipment. The results of the analysis will be a factor used by the F-16 System Program Office (SPO) to decide which type of training equipment to procure. The information provided by this study could also potentially impact on the cost and training effectiveness of other planned and existing systems. This analysis was requested by the F-16 SPO. The final product of this program will be a final life-cycle cost report from the contractor to the F-16 SPO. No AFHRL TR is planned.

This program will be conducted in two phases. Phase I (Aug.-Dec. 76) will be a general comparison of estimated cycle costs for each type of equipment and will be conducted in-house by AFHRL/AS. Phase I will provide early estimates of (1) the feasibility of meeting training objectives with simulated equipment, (2) the general configuration of the simulated equipment required to accomplish the training objectives, and (3) a general comparison of systems costs. Phase I results will provide input for initial decisions about equipment procurements and will be used to decide if a more detailed life-cycle cost comparison is warranted. If the results of phase I support the use of simulated equipment, phase II (Jan. 77-Dec. 77) will be conducted by industry under contract to the F-16 SPO, with AFHRL support. If conducted, phase II will be a detailed life-cycle cost comparison which will be based on the more extensive task and test station engineering data which is scheduled to become available in the Jan.-Dec. 77 time frame. AFHRL will prepare the statement of work for phase II with the assistance of the F- 16 SPO and will also provide technical management for the contract.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory ASR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0011, MEASUREMENT, PREDICTION AND EVALUATION OF BIOENVIRONMENTAL NOISE IN SUPPORT OF AF SYSTEMS/OPERATIONS

N.A. FARINACCI, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321430)

The goal is to provide technical support required by System Program Offices, MAJCOMS, airbases, AF labs, and others on specific environmental noise problems that would otherwise be outside the scope of AMRL's R & D program. This support provides 200 to 300 customers per year with the data, procedures, software, and guidance needed to define and evaluate crew and community noise problems caused by specific existing or planned Air Force operations. The range of problems include: AICUZ, noise exposure/levels for environmental impact statements, facility siting, real estate decisions, monitoring of airbase noise, sound propagation, runup noise suppressors, identifying hazardous noise areas/operations, and computational/analytical methods.

The approach is to measure, predict and evaluate the customer's specific noise problem by applying the instrumentation, measurement methods, noisebank, omega software, predictive methods and other tools developed by AMRL. Travel/per diem costs will generally be paid by the customer. Results will usually be documented in the form of letter reports or memoranda.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0012, EFFECTS OF AF PROPELLANTS AND CHEMICALS ON METABOLIC MECHANISMS

M.E. GEORGE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320700)

The purpose of this basic research is to identify and define those underlying physiological and biochemical mechanisms associated with the systemic toxicity of chemicals and material.

Studies on the effects of toxic, carcinogenic and mutagenic chemicals of special Air Force interest and application on metabolic pathways and mechanisms of action require use of radioactive tracers, gas and liquid chromatography coupled with mass spectrometry, and electron microscopic evaluation of cellular and subcellular changes. The ultimate application of these fundamental mechanisms is to facilitate extrapolation of animal data to humans by selecting the most appropriate laboratory animal species which handles the compound similar to the metabolic pathways of man.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. TH, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0013, COMPASS EARS

L.L. GRIFFIN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321000)

To provide human engineering criteria and design consultation in the design, development, test and evaluation of the compass EARS project. The emphasis of this support is upon the specification and selection of information display and communications equipments. The design and evaluation of workspace arrangement and environment, operator safety and design for maintenance also receive significant attention. It is anticipated that experimental research will be required to provide viable solutions for the system information handling, processing and transfer within the system.

Application of human engineering design criteria, within the framework of MIL-STD-1472B, to the interfaces, processes and performance of the system and technical evaluation of research proposals to the program manager for solutions of the longer range information processing problems which require system specific research.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0014, HEAD AND EYE MOTION IN MOIFE

C.B. HARRAH, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321260)

The objective is to quantitatively describe the motion of the head and eye in multiple-axis vibration environments associated with low- level, high-speed flight. These descriptions will be in the form of transfer functions or describing functions. These functions will have two uses which are (1) to predict the efficacy of helmet-mounted display and pointing systems in turbulent and buffeting flight environments and (2) as a subcomponent of a predictive model for visual performance in multiaxis oscillating inertial force environments (MOIFE).

The first step will be to quantitatively measure head motion. Several methods will be attempted including miniature accelerometers and helmet-mounted sight systems. Upon satisfactory completion of the head measurements the eye measurements will be undertaken. At this point in time these measurements are expected to consist of transfer functions derived from information concerning phase shifts and motion amplitude changes needed to stabilize oscilloscope patterns in the visual field of a subject undergoing whole body vibration.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0015, EXPERIMENTATION IN MOTION EFFECTS

A.M. JUNKER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322480)

Human operator performance is of central importance to manned weapon system effectiveness. There is no general procedure to evaluate the effects of motion environments on human operator performance and weapon system effectiveness. Costly and time-consuming tests could be eliminated or reduced if an analytical description of the human operator could be used in the initial design phase. The objective of this work area is to devise mathematical models of human operators which include the effects of motion environments. The effect of motion environments on weapon system performance can then be evaluated utilizing the changes in the human subsystem model.

Using current state-of-the-art modeling techniques, develop analytical descriptions of the human operator which incorporate the use of motion information. Conduct experiments and develop a data base on human operator tracking under motion conditions. Develop human operator models from the experimentally derived data base.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0016, RPV C 3 RECCE INTEGRATION

S.D. KAY, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322400)

The objective is to develop and implement the subsystem elements required to support representative simulation of Air Force RPV systems. This objective relates specifically to the modification and expansion of the AMRL RPV systems simulation to include: (a) an RPV reconnaissance subsystem, (b) representative RPV guidance (control) and imagery, (c) imagery processing for bandwidth reduction and enhancement, and (d) other simulations of RPV system elements (e.g., weather, enemy threats and jamming, etc.). The products of this technical work will be required subsystem element interfaces with the AMRL RPV systems simulation. Products will be in the form of hardware and/or software items, e.g., a numerical simulation model of jammer site.

The approach will be to perform an engineering/requirements analysis prior to the development of a simulation element (e.g., the numerical simulation model of a jammer site or the application of a digitization process to target area imagery). Each specific analysis will determine the requirements for the subsystem element in an RPV system, importance, method for implementation, and decision whether to proceed with development. If a decision to proceed with development results from the analysis, then development of necessary hardware and software will follow the analytical effort. Development will then be followed by implementation during which the subsystem element is interfaced with the AMRL RPV systems simulation such that it is an integrated operating element. A number of subsystem elements are planned to be interfaced with the AMRL RPV systems simulation. These are in the (a) through (c) areas identified in the objective. In addition, analytical efforts will be conducted regarding the eventual development of the AMRL RPV systems simulation into a test bed that is general to other AF C3 systems. A cooperative research effort with AFAL/AAD is planned to assess imagery processing and bandwidth reduction techniques. An analytical effort is planned to determine the elements of the RPV reconnaissance subsystem that will be simulated and integrated with the AMRL RPV system simulation.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0017, COMMUNICATION MEASUREMENT SYSTEM

R.L. MCKINLEY, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321340)

Future requirements of AFR 161-35 and more powerful propulsion systems of current and future aircraft call for research and evaluation of many different communication systems and devices. The objective of this effort is to develop and implement a research and testing system to simulate an operational communication environment and to develop standard research and testing procedures, and data reduction software for evaluation of AF voice communication systems and devices. This effort will support ASD life support SPO's and weapons systems development SPO's.

The approach is to develop a laboratory aircraft voice intercommunication system which is capable of reproducing a realistic and valid simulation of the operational environment. This will include a multi-station intercommunication system, a respiration system, appropriate terminal equipment (helmets, masks, headsets, etc.), accurate simulation of the spectra and levels of specific weapons systems' air and ground noise environs, radio static, auditory warning signals if feasible and various communication situations such as quiet to noise, noise to noise, and the like. The final experimental procedures will be standardized and software developed to provide descriptions of communication effectiveness in terms of the variables under investigation.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0018, EVALUATION OF THE USEFULNESS OF CXC PULSE PATTERNS IN A REAL-TIME SPEAKER VERIFICATION SYSTEM

T.J. MOORE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321520)

The objective of this work unit is to evaluate how well the analog pattern recognition system, known as the CXC system, can be used to verify the identity of a speaker by performing pattern classification on samples of speech. Potential applications are seen in base security operations by providing an automated system for controlling access to secure areas.

This work unit is the in-house companion of a portion of contractual work unit 72330332. The contract will provide necessary software development to use the system for this purpose. This work unit will define the features of the CXC pulse patterns produced from speech, that are dependent upon the particular speaker. In addition to looking for those features that might be unique to the physical characteristics of a particular vocal tract, we will look for features reflecting dialect and speech production habits that might be useful in characterizing an individual voice. The contract will develop a software program for extracting and utilizing the features. After achieving the automated capability this work unit will include a systematic evaluation of performance on a set of speakers.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0019, DIRECT VISUAL MECHANISMS OF NON-DESTRUCTIVE COUNTERMEASURES

R.D. ODONNELL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321090)

To develop and assess countermeasures against the human operator in representative threat systems which involve interference, deception, or neutralization of the visual system. To identify a large number of potential countermeasures, and to carry out a systematic, minimal-cost series of evaluations designed to eliminate low-probability concepts and isolate those with a high probability of success. To refine these concepts, maximizing their effectiveness, until sufficient testing has been done to deliver the concept to operational development. This work unit supports AFSC development goals SO-5, TC-5, and TC-8.

Candidate countermeasures will be identified through study of the fundamentals of visual mechanisms, and will be subjected to a series of increasingly more high-fidelity evaluations. In the first stage, a conceptual evaluation will be done to estimate the probability of visual confusion. Secondly, laboratory evaluations will be carried out on the basic mechanism concept. Third, combined laboratory/field evaluations will be performed. Finally, where justified, high-fidelity simulator and/or field tests will be carried out. Initial concept ideas, and the confusability matrices necessary for conceptual evaluation will be derived from complementary programs in AMRL. Laboratory facilities for carrying out the second level of evaluation presently include an image metric capability, a laboratory for assessment of visual perception, a five-channel Maxwellian view optical system, and a sophisticated eye tracking system. Capability for novel psychophysical and psychophysiological evaluations is being developed. A mobile laboratory system capable of tracking real aircraft, and of simulating a broad range of countermeasures, will be placed in operational use in order to carry out the third level of evaluation. Other programs in AMRL are developing high-fidelity simulators and a metric for quantification of the threat environment. Suggested countermeasures concepts may enter the evaluation sequence at any level, depending on their previous level of investigation.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0020, BIOMECHANICS FOR COCKPIT DESIGN

W. HOVEY, Univ. of Dayton, Res. Inst., *Dayton, Ohio* 45409 (DF317180; F33615-75-C-5092)

The primary goal of this effort is the final documentation and preparation of a user's guide for the computer biomechanical man-model (COMBIMAN) program. It also is for incorporating into COMBIMAN additional features for: (1) demonstrating effects of personal- protective equipment on body size and reach capabilities of man in the cockpit and (2) presenting COMBIMAN as a two-dimensional, profile representation of the man/cockpit interface. This effort also provides support to in-house programs in the form of computer programming for preparing in standard format basic computer programs for analyses and presentation of anthropometric data required for the sizing, design, and procurement of personal- protective equipment and layout of work stations of USAF systems and technical assistance for developing data required for the design and placement of controls in cockpits of advanced systems.

Systems analyses, flow diagrams, and computer programming procedures will be followed to develop interactive graphics program for design engineers and standardized formats for data analyses purposes. AMRL force testing devices will be used to obtain information for the design and placement of controls in cockpits of USAF systems.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0021, NAVAL MARITIME AND ROTARY WING UNDERGRADUATE PILOT TRAINING REQUIREMENTS

D. MANLY, Veda Incorporated, *Southampton, Pennsylvania* 18966 (DN681168; N62269-76-M-6037)

Define the pilot training requirements for the current and future undergraduate maritime (prop) and rotary wing pipelines. This contract supports work unit DH810, agency accession no. DN 233303.

Interview cognizant personnel in CNATRA (Chief of Naval Air Training) and CNET (Chief of Naval Education and Training). Analyze training syllabi, flight training instruction and related documentation.

ADDENDA: Supporting agency address is: Naval Air Development Center, Sys. Analysis and Eng. Dept., Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0022, BLOCK PROGRAM BIOMEDICAL TECHNOLOGY PERSONNEL PROTECTION AND SURVIVAL

D.A. MANCINELLI, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN681085)

To provide solutions to aircrew personnel problems related to the scope of the subproject, by improving and expanding on the applicable technologies. In meeting the objectives, development may be in response to new requirements, or result from state-of-the-art advances which provide new approaches to problems. Proposed solutions to specific aircrew problems are developed and evaluated for feasibility and practicability. Fulfillment of these objectives may involve development of new techniques and products, or application of existing techniques and products in innovative ways.

Development efforts to meet the primary objectives include the experimental development of or search for new materials, components, techniques of fabrication, subsystems and systems. Efforts will vary from the fundamental to the sophisticated application of the principles of science, engineering, and psychology.

ADDENDA: Supporting agency address is: Naval Air Systems Command Tech. Admin. (Equip. and Support), Washington, D.C.

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0023, SPATIAL RESOLUTION THRESHOLDS DURING THE COURSE OF DARK ADAPTATION

P. SPEROS, Texas Technological University, School of Medicine, *Lubbock, Texas* 79409 (DA0C7888)

The object of this research is to determine the visual capability of aircrew at different times during recovery from image intensifier adaptation. Optical image intensifiers serve to aid night vision by amplifying the amount of light reaching the retina. The result is an improvement of visual capability employing night vision devices. If the night vision device fails, as they do without

warning, the operator will suddenly find himself visually impaired because of his elevated adaptation level. The time to fully recover dark-adapted vision varies from one to three minutes, depending upon the mean luminance preceding the device failure. This research will determine visual capability of the operator at different times during recovery from image intensifier adaptation.

The approach is to measure dark adaptation of five young adult males following adaptation to the chromaticity and luminance levels which span the range of the AN-PVS 5 night vision optical image intensifier. All experimental parameters will be nested in a 3 (viewing conditions) x 3 (pre-adaptation luminance) x 2 (background luminance) matrix design. Thus, contrast sensitivity functions for selected post- adaptation times generated by determining the contrast threshold at each spatial frequency for a given post-adaptation time can be determined.

ADDENDA: Supporting agency address is: MDRDC Environmental Protection Research Division, Washington, D.C. 20314

SUPPORTED BY U.S. Dept. of Defense - Army

6.0024, ENVIRONMENTAL INTERACTIONS AND PHYSIOLOGICAL REQUIREMENTS DURING FLIGHT

T.R. MORGAN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322260)

Recent emphasis on reassessment of life support system design criteria, and the need to investigate specific biomedical hazards of flight, have established the necessity of measuring aircrew physiological requirements under conditions of actual flight. Information is needed which will permit derivation of future breathing system design criteria, oxygen generation/storage requirements, and provide an index of aircrew workload/stress in representative flying roles. Such information is especially important in cases where aircraft performance, or mission requirements, are of uncertain (possibly negative) effect on the crewmember's physiological capabilities/tolerances, or where they may drive physiological (i.e., respiratory/metabolic) needs beyond the capabilities of life support equipment employed. In an effort to identify cases in which these conditions may exist, the present effort provides for physiological monitoring of crewmembers engaged in selected operational flying roles. Previous accomplishments in this area are documented under work unit 7164-17-02. This work unit is being established to implement a new technology planning objective as directed by HQ Aerospace Medical Division.

An inflight physiological monitoring device, providing magnetic tape record of selected environmental and physiological stresses of flight, has been developed under contract (work unit 7164-17-05), and subsequently tested in USAFSAM environmental chambers, and on the human centrifuge. The device provides continuous, simultaneous record of the crewmember's expiratory flow, inhaled/exhaled oxygen concentration difference, and electrocardiogram, together with records of maneuvering load (gz) and cabin altitude. A binary time code (IRIG-b) and cockpit voice communications are also recorded. Physically, the system consists of an instrumented oxygen mask and associated sensor/signal- conditioning/recorder circuitry, of sufficiently small size and weight to permit its installation in selected pockets of the crewmember's survival vest, or (where clothing or equipment compatibility requires) any easily accessible cockpit space. Three copies of the system exist and will be stationed with selected field organizations for use in representative mission roles.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0025, CRITERIA FOR HUMAN EXPOSURE TO THERMAL STRESS

S.A. NUNNELEY, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322590)

The goal of this effort is to set criteria for acceptable thermal stress in Air Force operations. Improved understanding of the mechanisms involved will allow development of useful predictive models as well as leading to new concepts for protective measures where stresses exceed permissible levels. Information derived will be used to provide guidance for USAF engineering groups and operational commands concerning design and use of environmental control systems and protective equipment.

Selected thermal conditions will be simulated in the laboratory where volunteer subjects can be intensively studied. The environments used will be based in part on field measurements obtained under other work units. Because physiological heat strain is a complex product of multiple factors, studies will include the effects of clothing, work rate and duration of exposure. The impact of vapor barrier clothing on heat tolerance will be tested for application to current maintenance practices as well as potential chemical defense requirements. The possible protective effects of acclimatization, physical fitness, and fluid replacement will be studied. Measurements will include core and skin temperatures, evaporative loss, heart rate, metabolic rate, body fluid composition, and performance. This effort supports the ASD development of aircrew equipment and the AFFDL development of advanced environmental control systems. Coordination is being accomplished with the U.S. Army (ARIEM), USN, NASA, AFOSR, and civilian agencies. This work was formerly done under work unit 7164-17-24.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0026, HUMAN CAPABILITY VERIFICATION OF AIRCREW LIFE SUPPORT EQUIPMENT

R.L. STORK, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322660)

During the past four years, a close alliance has evolved between USAFSAM and the 412A Life Support SPO, based largely on the human compatibility evaluation of life support equipment. That work was previously done in work unit 7164-17-11, and due to a divisional restructuring, was transferred to this work unit. The goal of this work unit is to provide an independent Air Force judgement on the effectiveness of new aircraft equipment, and to identify problems associated with new concepts prior to the cost, risk, and visibility of a field OT & E.

Evaluation of criteria and human compatibility will be documented under this work unit; when data indicate a need for new or revised criteria, specifications, or technology, coordination/handoff to the relevant work unit will occur. Close coordination will be established and maintained with potential USAF customers such as 412A Life Support SPO and ASD. Evaluation requirements are usually short-term and will be partially or fully reimbursed.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0027, INTEGRATED AEROMEDICAL DATA BASE AND DECISION SYSTEM

G. TOLAN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322070)

The primary objective of the integrated aeromedical data decision system is to facilitate follow-up studies on fliers evaluated in the past in order that waiver authorities can better determine whether today's fliers with the same findings should be returned to duty. Additional objectives include identifying candidates for special studies, determining the probability of obtaining a waiver for any given condition, and describing the medical profile of special study groups.

In order to reduce data capture errors, state-of-the-art as well as innovative methods will be implemented that capture data as close in time and place to its creation as is possible. Data will then be machine verified and echoed back to its source for reconfirmation. In order to permit correlation of a patient's data across different source-oriented medical data repositories, an algorithm for verifying each patient's unique identifier will be implemented. In order to protect uniquely identifiable medical data from unauthorized access or alteration, while simultaneously increasing the data availability to the end users, repositories will be incorporated into a data base management system. Efforts were previously under work unit 7755-14-08.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0028, VISUAL STANDARDS
T.J. TREDICI, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321770)

Aircrew must be able to maintain continuity of vision in their operation of manned aerospace vehicles. Review and update of the visual standards for entry and retention in the flying specialties is essential to insure visually qualified members in sufficient numbers capable of performing the mission.

Liaison with the Army and Navy on visual standards for aircrew will be maintained, and coordination with FAA on standards for category classifications of commercial pilots will be on a continuous basis. Dynamic stress effects on the visual system will be investigated. Ocular aging will be studied to assure proper physical standards criteria, therapy, and/or prevention. Efforts previously under work unit 7755-09-04.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0029, WINDSHIELD QUALITY AND PILOT PERFORMANCE
C.L. KRAFT, Boeing Company, *Seattle, Washington* 98108 (DF320150; F33615-76-C-0516)

The research effort being procured is in direct support of (and is being funded by) the AFFDL Improved Windshield Protection Advanced Development Program Office (ADPO). The effort is an integral part of a joint AMRL/SAM program to investigate the visual factors associated with windscreens and the assessment of the effects of these factors on pilot performance. The specific objectives of this research are to measure the performance of aircraft pilots using windscreens of known optically distorted quality and to relate the performance to pilot vision measurements and to physical characteristics of the windscreen panels. The ultimate objective is to establish design criteria and military specifications for windscreen quality.

The approach to be followed requires the extensive measurement of pilot (subject) vision characteristics, the utilization of a series of experimental windscreen panels of known, controlled distortion in an aircraft night landing simulator, and the measurement of pilot performance under different conditions of flight. The relationship between pilot performance and various measures of distortion will be determined. This will allow specifications to be formulated for minimally acceptable windshield quality for new aircraft and replacements in current aircraft.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, THE EVALUATION OF TURBULENCE MODELS BY NUMERICAL SOLUTIONS OF THE NAVIER-STOKES EQUATIONS
J. FERZIGER, Nielsen Engin. & Research Inc., *Mountain View, California* 94040 (DN775080; N00014-77-C-0008)

The development of accurate models of turbulence is central to the formulation of reliable design methodologies for predicting viscous flow phenomena associated with aircraft, missiles and ships. The proposed research will utilize 'exact' solutions of the Navier-Stokes equations to assess commonly used turbulence closure models.

In the present research, the Navier-Stokes equations will be solved, numerically, by finite-difference and spectral methods to provide numerical data with which turbulence closure models can be assessed. Initially, calculations by finite-difference and by spectral methods will be compared for the case of homogeneous isotropic flow. Subsequently, the spectral method will then be used to predict homogeneous nonisotropic (mean shear and strain) flows.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0002, STOCHASTIC FILTERING AND CONTROL
T.E. DUNCAN, Univ. of Kansas, School of Liberal Arts & Sci., *Lawrence, Kansas* 66045 (DF046660; AF-AFOSR-3177-77)

AF function - the study of Air Force aerospace systems and conventional systems. Deficiency - the control of a linear system is a mathematically straightforward task. However most physical systems are inherently nonlinear and need new techniques for control. Objective -the objective of this research is to investigate the stochastic filtering and control of stochastic systems which are modelled by stochastic differential equations in the tangent bundle of a smooth manifold. How work contributes - success here would result in improved performance of physical Air Force systems.

Research will proceed in various problems in stochastic filtering and control in the setting of some manifolds, specifically models given by stochastic differential equations in the tangent bundle of a Riemann manifold. Compact Riemann manifolds will be investigated first to insure that there are no finite escape times for the stochastic differential equations. This manifold formulation should allow for the identification of equivalent filtering problems in different manifolds and control for processes in Euclidean n-space, and therefore the notion of stochastic integrals in a manifold should also be important for the solutions of stochastic filtering and control problems in a manifold. The investigations of manifold-valued stochastic integrals will be continued.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0003, THE CONSTRAINT METHOD FOR SOLID FINITE ELEMENTS
I.N. KATZ, Washington University, School of Arts & Sciences, *St. Louis, Missouri* 63130 (DF046190; AF-AFOSR-3122-77)

AF function - design of future aerospace vehicles. Opportunity -new techniques which allow control of the order of approximating polynomials and the number of elements in each division in 2-d finite-element stress analysis are presently available. Objective - this research will examine such techniques for the purpose of extending them to 3-d finite-element stress analysis. How work contributes - results may be useful in the design and analysis of 3-d structures in future aerospace vehicles.

This research will investigate the constraint method in finite-element stress analysis. In particular, the following problems will be studied: (1) Development of hierarchical family of solid finite elements of arbitrary polynomial degree. Initially, in analogy with the 2-d case, a tetrahedronal family will be developed. (2) Investigation of the rate of convergence as a function of polynomial degree, for solid elements. It is conjectured that convergence rate will be higher than that obtained by decreasing element size. (3) Study of an error controlled rezoning scheme. (4) Development of curved elements in both two and three dimensions. (5) Computational experiments to verify results will be performed.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0004, DATA CORRELATION AND AQUISITION PROGRAM (DCAP)
R.K. MATTEWS, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF420985; F40600-75-C-0001)

A multichannel data system will be designed and fabricated to acquire and record wind tunnel-flight test data. The system will be designed to fit into existing external stores such as the BDU-12

and will be completly self-contained. Measurements on the store in the wind tunnel and in flight will include temperature, pressure, heat-transfer rate, time, and voice channel. Check-out of the data acquisition system will be accomplished in the wind tunnel and in flight.

To define aerodynamic heating and thermal environmental effects on the design and operation of externally carried stores requires both a wind tunnel and flight test program which will yield not only the primary data such as store temperatures, but also aerodynamic measurements of heating rates and pressure distributions, and therefore a specially designed airborne data acquisition system for measuring and recording of data for subsequent analysis is needed.

ADDENDA: Supporting agency address is: Arnold Engineering Development Center, Arnold AFB, TN 37389

SUPPORTED BY U.S. Dept. of Defense - Air Force

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, LIGHT SCATTERING STUDIES OF THE FAR INFRARED DIELECTRIC PROPERTIES OF SEMICONDUCTORS

S. USHIODA, Univ. of California, School of Physical Sciences, *Irvine, California* 92664 (DF047080; AF-AFOSR-3222-77)

AF function - aerospace communications, surveillance and detection systems require electrooptical devices which exploit the special properties and interactions of infrared radiation with solid-state materials. Opportunity - the far infrared region of the electromagnetic spectrum has been virtually unexplored for airborne and satellite applications. Sophisticated electrooptical techniques and characteristics of narrow band-gap compound semiconductors offer promise for electrooptical microcircuitry in the spectral range 10 to 100 micrometers. Objective - the main purpose of this research is to explore the far infrared dielectric properties of several semiconductors, in the bulk and near the surface, by means of inelastic laser light scattering spectroscopy, and to study elementary excitations that contribute to the dielectric properties such as phonons, bulk and surface polaritons, plasmons, and low-lying single-particle electronic excitations. How work contributes - the far infrared dielectric (optical) properties of these semiconductors are important to the development of infrared detectors, solid-state lasers, integrated optics and electrooptical techniques and device concepts.

Laser Raman scattering spectroscopy utilizing tunable dye lasers is being used to probe the far infrared properties of semiconductors. For the study of the surface layers of III-V and II-VI compound semiconductors, back-scattering Raman spectroscopy will be used. For the study of surface polaritons, thin-film layered structures are being synthesized by vapor deposition techniques to clarify the mechanisms for electron-phonon interactions and for generating surface waves in these materials.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0002, ANISOTROPIC AND ELECTROOPTICAL EFFECTS IN LIQUID CRYSTALS

J.D. MARGERUM, Hughes Aircraft Company, *Malibu, California* 90265 (DF046390; F49620-77-C-0017)

AF function - the Air Force capabilities in flight operations rely on continuing advances in navigation, guidance, reconnaissance, and surveillance programs. Deficiency - these is a continuing need for new methods, techniques, and devices for the automatic capability in recognizing data patterns and new information. Objective - research is concerned with the chemical and physical structural effects of liquid crystalling components on the related electrooptical properties. How work contributes - results will contribute to the device work on liquid crystals projects on developing flat panel matrix displays for airplane cockpits, electronic reticles for fire control systems and screen projection displays.

This research is directed toward understanding of the effects of dopant and liquid crystal structures on the anisotropic properties involved in electrooptical effects. A study is to be carried out on the effect of size, shape, and structure of conductive dopants and the effect of chemical structure variations in liquid crystals, using selected liquid crystals and selected dopants respectively, on the conductive anisotropy of each. The effect of the conductivity anisotropy ratio on the dynamic scattering characteristics of various liquid crystals/dopant systems in transparent cells with surface alignment will be investigated along with the cybotactic nematic phase character in liquid crystal mixtures. The effects of temperature on their dynamic scattering response will also be studied.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0003, THEORETICAL LOW-ENERGY NUCLEAR PHYSICS

D. ROBSON, State University of Fla. Sys., School of Arts & Sciences, *Tallahassee, Florida* 32306 (PHY74-02673 A03)

Research initiated under NSF Grant PHY74-02673 AO1 will be continued. Topics in theoretical nuclear physics to be investigated include: Inelastic scattering (F. Petrovich): a) inelastic heavy-ion scattering; b) inelastic proton scattering; c) structure calculations; d) inelastic pion scattering. Nuclear many-body studies in the continuum (R. J. Philpott): a) continuum shell model calculations; b) three- and four-body problems; c) core plus two-nucleon model. Nuclear reaction studies (D. Robson): a) separable interactions in nuclear reactions; b) coupled reaction channels theory; c) exchange terms in heavy-ion scattering; d) four-nucleon transfer reactions and alpha- particle-like models. Direct reaction analyses with the exact finite- range DWBA computer code FANLU2 (Steve Edwards): a) DWBA cluster-charge exchange model for (HE3,t) reactions; b) (HE3', alpha) reactions in 1-p shell nuclei; c) other applications.

SUPPORTED BY U.S. Natl. Science Foundation

8.0004, INTERMEDIATE-ENERGY NUCLEAR PHYSICS

R.E. SEGEL, Northwestern University, School of Arts & Sciences, *Evanston, Illinois* 60201 (PHY76-82433)

A continuing program in nuclear and intermediate-energy physics is planned with two major experimental efforts: 1. Studies at LAMPF of the interactions of pions with complex nuclei will be continued to study the charged particles and photons emitted. A survey of pion elastic scattering from nuclei is planned using EPICS (the energetic pion channel and spectrometer). 2. Studies similar to those at LAMPF will be studied at the Indiana University Cyclotron Facility using similar techniques to study the interactions of 100 - 200 MeV protons with nuclei. Both charged particles and photons emitted from the interactions will be studied, and coincidence measurements will also be made.

In addition to these major programs, some low-energy nuclear physics experiments will be performed at the tandem laboratory of Argonne National Laboratory.

This work is a continuation of that currently supported by Foundation grant PHY74-23981 A01.

SUPPORTED BY U.S. Natl. Science Foundation

8.0005, THEORETICAL NUCLEAR STRUCTURE STUDIES FOCUSING ON THE PHYSICS OF HEAVY-ION INDUCED EXCITATION PROCESSES

J.P. DRAAYER, Louisiana State Univ. Systems, Graduate School, *Baton Rouge, Louisiana* 70803 (PHY76-13143)

A research program in theoretical nuclear physics will be initiated. It will focus on what can be learned about the structure of nuclei utilizing the selectivity of heavy-ion induced excitation processes. Draayer will devote his efforts to two distinct yet complementary model studies. The first is part of a continuing investigation designed to test the feasibility of providing a micro-

scopic shell-model description of multinucleon transfer processes. The second involves applications of recent theoretical advances in spectral distribution studies.

SUPPORTED BY U.S. Natl. Science Foundation

8.0006, THEORY OF ATOMIC STRUCTURE
B.R. JUDD, Johns Hopkins University, School of Arts & Sciences, *Baltimore, Maryland* 21218 (PHY73-05195 A03)

Research in theoretical atomic physics initiated under NSF grant MPS73-05195 AO1 will be continued. Specific topics in the interactions of atoms with fields in a solid and with intense laser beams include: 1. The Jahn-Teller Effect for an F ion center and for actinide ions at octahedral sites in crystals; 2. Group-theoretical properties of atoms, including radial as well as angular features; 3. n-j symbols and their connection with the four-dimensional spherical harmonics used in the analysis of small molecules; 4. Many-body theory, especially the random-phase approximation; 5. Quantum optics, including multiphoton ionization.

SUPPORTED BY U.S. Natl. Science Foundation

8.0007, ATOMIC PHYSICS EXPERIMENTS USING FAST ATOMIC BEAMS
F.M. PIPKIN, Harvard University, Graduate School, *Cambridge, Massachusetts* 02138 (PHY76-14857 A01)

Fast atomic beams are used in conjunction with laser and rf spectroscopy techniques to make precision measurements of the fine and hyperfine structure of the excited states of hydrogen-like atoms and to study charge exchange collisions.

This work is a continuation of that currently supported by Foundation grant MPS74-13728A01.

SUPPORTED BY U.S. Natl. Science Foundation

8.0008, TRANSPORT IN METALS AT ULTRA-LOW TEMPERATURES
F.J. BLATT, Michigan State University, School of Natural Sciences, *East Lansing, Michigan* 48824 (DMR75-01584 A02)

With a helium dilution refrigerator and superconducting quantum interference devices, it is not possible to make high-precision measurements of the electronic transport properties of ultra-pure metals and their alloys to temperatures below 20 K. A system capable of such measurements has been assembled and now will be used to completely determine the transport coefficients of various metals by measuring their electrical resistance R, thermal conductance K, thermopower S, and thermoelectric coefficient G. Initially measurements will be done on ultra-pure samples of tungsten, platinum, silver, and potassium, then the effects of cold-working, size limitations, and alloying will be studied.

This is a continuation of research supported under DMR-7501584 A01, and is the third year of funding for a three-year continuing grant.

SUPPORTED BY U.S. Natl. Science Foundation

8.0009, HIGH YIELD NUCLEAR ACOUSTIC RESONANCE STUDIES OF SINGLE CRYSTAL METALS, INSULATORS, AND SEMICONDUCTORS
R.K. SUNDFORS, Washington University, School of Arts & Sciences, *St. Louis, Missouri* 63130 (DMR76-80158)

A series of experiments on single-crystal transition metals with known concentrations of hydrogen, on other pure non-cubic metal single crystals, on pure germanium, and on the alkali bromides will be continued. Nuclear acoustic resonance (NAR) using both dynamic quadrupole coupling and dynamic Alpher-Rubin coupling will be employed where possible as the experimental technique. High magnetic fields up to 85 kilogauss in the temperature range from 4.2 K to 300 K will be used with on-line computer signal averaging and data analysis. The NAR dynamic quadrupole coupling and Alpher-Rubin coupling lineshapes, linewidths, and line positions of Ta181 will be studied in single-crystal tantalum as a function of hydrogen concentration and temperature in both the alpha and alpha and beta phases. The H1 linewidths and line positions will also be studied if the resonance proves observable in tantalum. Extensions of these studies are planned for V, Nb, and Pd. NAR lineshape, linewidth, and line-position studies will be carried out at the highest magnetic fields in single-crystal Be and Mg. NAR studies using dynamic quadrupole coupling of Ge73 in pure germanium single crystal to determine lineshapes, linewidths, and the components of the tensor S relating electric field gradients to elastic strain will be carried out. Finally, NAR dynamic quadrupole coupling studies of the alkali bromides to determine the components of the tensor S observable at anion and cation nuclear positions will be done.

This is ths first year of a two-year continuing grant.

SUPPORTED BY U.S. Natl. Science Foundation

8.0010, THIN SEMICONDUCTING FILMS DEPOSITED BY SPUTTERING
R.J. SOUKUP, Univ. of Nebraska, Graduate School, *Lincoln, Nebraska* 68508 (DF046480; AF-AFOSR-3155-77)

AF function - microwave solid-state devices are essential elements of Air Force communication, reconnaissance, surveillance, and countermeasure systems. Improved performance of devices that generate and process microwave signals can be expected from use of purer solid- state materials and sharper boundaries between these materials. Opportunity - present microwave solid-state device performance is limited by the inability to grow very thin, high-purity, low-defect, uniformly doped layers with abrupt doping levels. Thin films are currently produced by several methods such as liquid phase epitaxy (LPE), chemical vapor deposition (CVD), and sputtering, each having advantages and disadvantages. Objective - the objective of this research is to improve the sputtering technique for doped compound semiconductor thin films. How work contributes - this research will add to the body of knowledge required for the determination of the potential of the sputtering technique in comparison with other methods of producing doped semiconductor thin films.

A compound semiconductor such as GaAs will be sputtered while cosputtering a constituent of the compound to maintain stoichiometry and/or cosputtering an impurity dopant. The electrical and transport properties of the sputtered film will be determined.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg. 410, Bolling AFB, Washington, D.C. 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0011, STRONG INTERACTIONS UTILIZING MAINLY THE FERMILAB 30' BUBBLE CHAMBER HYBRID SPECTROMETER
R.J. PLANO, Rutgers the State University, School of Arts & Sciences, *New Brunswick, New Jersey* 08903 (PHY77-02188)

An active program in the study of hadronic interactions is in progress. 1. The Fermilab 30 inch bubble chamber - electronic detector hybrid system is used to study interactions induced by pions, kaons and antiprotons of 150 GeV/c momenta in hydrogen. 2. Analysis of a bubble chamber exposure to 15 GeV antiprotons incident on deuterium will be completed.

Major contributions are being made to the Fermilab hybrid spectrometer system. These are the forward gamma detector and downstream drift chamber electronics.

This work represents a continuation of that currently supported by Foundation grant PHY76-00893 A03.

SUPPORTED BY U.S. Natl. Science Foundation

8.0012, ELEMENTARY PARTICLE PHYSICS
G.K. ONEILL, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (PHY77-03318)

Studies of states of matter produced in electron-positron annihilations at several GeV center of mass energy will be performed at the SPEAR storage ring in collaboration with groups from several other universities and the Stanford Linear Accelerator Center. The investigations are intended to yield information on the character of new states of matter, particularly those containing a charm quark structure, and consists of two parts.

1. Analysis of data acquired previously on inclusive distributions, K/pi meson yields, anomalous micron meson production and spectroscopy of photons will be completed. The preliminary results of this data, acquired in a collaborative effort with groups from Stanford, Maryland, and University of California, San Diego, already have conclusively shown the existence of the 'charmonium atom'. 2. Use of high-precision electromagnetic detector to study processes in which mostly neutral hadronic states or leptonic states of matter are produced. This experiment, which will be initiated during the present calendar year, is a collaborative one between groups from Harvard, Stanford, California Institute of Technology, Princeton and SLAC and is expected to yield complementary information to that obtained from the magnetic detector.

This work is a continuation of that currently supported by Foundation grant number PHY76-06642.

SUPPORTED BY U.S. Natl. Science Foundation

8.0013, OPERATION OF THE NUCLEAR STRUCTURE RESEARCH LABORATORY

H.E. GOVE, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (PHY76-80894)

The proposed grant will provide funds for operation of the laboratory and research program. In addition, modest continued upgrading of the MP tandem Van de Graaff accelerator and improvement of major detector apparatus is proposed. At this time, the recent upgrading program, utilizing relatively low-cost accelerator tubes, has resulted in higher voltage accelerator performance. The proposed research program is well matched to the higher energy heavy-ion beams now available. Some research work will extend areas of nuclear physics which, to a large extent, have been pioneered in this laboratory. These include 6Li induced alpha-particle transfer reactions and quadrupole moment measurements of nuclear excited states. Among the interesting new topics proposed for study are: 16O induced alpha-particle transfer reactions (which may reveal alpha clustering in nuclei) on heavy targets; mechanisms of heavy-ion collisions; determination of spheroidal or ellipsoidal shapes associated with nuclear collective motions; and the behavior (phase changes) of nuclei with large angular momenta.

This work is a continuation of that currently supported by Foundation grant PHY75-21105.

SUPPORTED BY U.S. Natl. Science Foundation

8.0014, ELECTROMAGNETIC INTERACTIONS OF MESON RESONANCES

E.H. THORNDIKE, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (PHY76-84034)

This group is involved in experiments at the Cornell Synchrotron and at Fermilab.

1. At Cornell an experiment is in progress to measure the branching ratio for the radiative decays of neutral vector mesons into pseudoscaler mesons; rho 0 yields eta 0 gamma, omega 0 yields eta gamma.

2. The radiative couplings between charged vector mesons and pseudoscaler mesons are to be measured at Fermilab by observing the inverse of the decay reaction. A beam of charged kaons or pions interacts with the Coulomb field of a nucleus to produce vector mesons in the final state. In addition to the radiative processes other reactions of pions, kaons and anti-protons diffractively dissociating into two-body systems will be measured.

This work represents a continuation of that currently supported by Foundation grant PHY75-02487 A02.

SUPPORTED BY U.S. Natl. Science Foundation

8.0015, CHARACTERISTICS OF III-V SEMICONDUCTORS

D.C. LOOK, Univ. of Dayton, Graduate School, *Dayton, Ohio* 45409 (DF105310; F33615-76-C-1207)

There is a stated Air Force need for systematic evaluation and characterization of the electronic properties of the materials used in Air Force avionics systems. At present the electronic defect structure, surface and interface properties of these compound semiconductors used for microwave and opto-electronic devices are not well understood. The objectives of this contract are to identify and completely characterize the electronic defect structure of epitaxial and substrate compound semiconductors used in opto-electronic and microwave devices and to investigate the electronic properties associated with the surfaces and interfaces of the materials. The ultimate goal is to solve the material problems that affect the performance of the solid-state devices by conducting a thorough characterization study of materials, processes, and devices.

The objectives of this on-site contractual program will be accomplished by gaining information regarding defect structure of the materials. Shallow or deep impurities and defects will be probed and identified by high-resolution bandgap photoluminescence, near and/or far infrared spectroscopy, and electrical transport measurements. Electron bombardment will be employed to identify intrinsic point lattice defects. The physical position of the traps with respect to the surface or interface will be deduced from c-v measurements, and the trap depth distribution is to be determined by c-v, thermally stimulated conduction (TSC) and thermally stimulated luminescence (TSL) measurements, as applicable for different samples. Spatially resolved photoluminescence and X-ray topographic observations will be used to assist in determining the homogeneity of large samples. The results will be compared with electron-irradiated and ion-implanted materials.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0016, INVESTIGATION OF LASER-INDUCED PRE-BREAKDOWN MATERIAL MODIFICATIONS

P. BRAUNLICH, Washington State University, Graduate School, *Pullman, Washington* 99163 (E(45-1)-2221)

Previous studies by this group led to the discovery of strong emission of halogen atoms from certain alkali halides during exposure to intense laser beams at peak fluxes below the laser damage threshold. The atomic emission occurs in well defined crystallographic directions around the axis of the laser beam. This phenomenon is a clear demonstration of pre-breakdown modifications of the optical material which, upon repeated exposure to intense laser pulses, will lead to catastrophic failure. The present investigation is concerned with a systematic study of the described effect at various laser wavelengths which are of interest to the technology of high-power lasers. Materials to be investigated include alkali halides and, if possible, certain sulfides.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - L.F.D.

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, THEORETICAL STUDIES IN INTERSTELLAR PHYSICS

C. MCKEE, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (AST75-02181 A02)

A wide variety of theoretical problems in stellar, interstellar, and high-energy astrophysics will be considered. In stellar astrophysics, the research will include the investigations of mass transfer and accretion onto magnetized neutron stars; non-local thermodynamic equilibrium theory of X-ray reprocessing in stellar atmospheres; and an atlas of theoretical light and velocity curves of contact binaries. Interstellar problems will include the research on the interactions of gas, dust, molecules, and stars; cloud evaporation; collapse of interstellar clouds and binary star formation; and the properties of the hot component of the interstellar medium. The main effort in high-energy astrophysics will be the study of astrophysical processes which occur in or near exotic objects such as pulsars and quasars. In particular, processes concerned with radiative Rayleigh- Taylor instabilities, compact variable sources, and dynamics and excitation in the Crab nebula will be considered.

This is a continuation of work previously supported by NSF grant AST75 02181.

SUPPORTED BY U.S. Natl. Science Foundation

10.0002, VIKING ORBITER
M.H. CARR, U.S. Dept. of the Interior, Geological Survey, *Menlo Park, California* 94025 (9580-00760)

During the current fiscal year the Viking Orbiters will continue to take pictures of Mars at a rate of approximately 50 per day. Early in March the periapsis of Orbiter 1 will be lowered from the current altitude of 1500km to 6-800km in order to improve resolution. The plan is to systematically map the planet under optimum lighting and viewing conditions, concentrating on near periapsis photography in the first half of the year and high-altitude photography in the second half. The global dust storm is expected to start in June and engulf the entire planet for six months. Its growth and decay will be mentioned as well as its effects in mobilizing near-surface materials. This systematic acquisition of high-resolution photography is aimed primarily at improving our knowledge of geologic processes on Mars and the geologic history of the planet.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

10.0003, ELECTRONOGRAPHIC ASTRONOMICAL PHOTOMETRY
M.F. WALKER, Univ. of California, Lick Observatory, *San Jose, California* 95060 (AST75-14347)

The following programs in astronomical electronographic photometry will be carried out: Completion of reduction of the electronographic observations of stars in clusters associated with the Magellanic Clouds, which were obtained with the Spectracon and the Cerro Tololo 60-inch reflector in 1968-1969. Continuation of current observing programs which include: UBV photometry of stars in galactic globular clusters and local group galaxies, down to at least V equals 22; a search for the optical pulses of radio pulsars; observations of the faint outer parts of extragalactic nebulae and of luminous connections between galaxies of greatly different redshift.

SUPPORTED BY U.S. Natl. Science Foundation

10.0004, PROBLEMS OF BINARY STAR EVOLUTION - INSTABILITIES AND UNSTEADY STATES
J. FAULKNER, Univ. of California, Graduate School, *Santa Cruz, California* 95060 (AST75-09751 A01)

Studies will be carried out on the exchange of mass and energy between the members of close binary stellar systems. The particular emphasis of these studies will be an examination of the instabilities and unsteady states occurring during such mass exchanges. There will be a treatment of instabilities taking place beneath the surface of the star which is transferring mass to its companion. This will be done in order to determine whether the timescales of such instabilities are responsible for the repetitive nature of the outbursts seen from these systems. It is also possible that such sub-surface instabilities modulate some more fundamental mechanism which is causing the repeated outbursts. The techniques will be applied to a variety of models, and an attempt will be made to obtain predictions on the behavior of observational properties of these systems. The dynamic behavior of a neutron star as it enters the central region of a supergiant star with which it shares a common envelope will be studied. Such an evolution may be a step in producing a binary pulsar. This is a renewal of work previously supported by NSF Grant AST 75-09751.

SUPPORTED BY U.S. Natl. Science Foundation

10.0005, ORIGIN OF COMETS AND THE EVOLUTION OF THEIR ORBITS
E. EVERHART, Univ. of Denver, Denver Research Institute, *Denver, Colorado* 80210 (AST76-18891)

Comets are believed to be very numerous in the solar system but become visible only when they approach the sun to within a few times the earth's distance from the sun. On each such approach to the sun, the comet nucleus is wasted and eventually it ceases to shine. Cometary debris in the inner solar system is often encountered by the earth and a number of showers of meteors are found to be related to former comets or comets still seen to shine on their repeated approaches to the sun.

Comet motions are perturbed by the much more massive planets; and the orbits are changed either to bring them nearer to the sun or even to eject them from the solar system. In either case, the number of comets to be seen from the earth is reduced. A widely held theory due to Oort predicts that there is replacement of this number from a huge cloud of comets orbiting the sun at a large distance. Perturbations of passing stars may cause some comets to fall in toward the sun and replenish the supply in the inner solar system.

A program to study the origin of comets and the evolution of their orbits will be continued. The effects of the four major planets and of passing stars will be included. The Monte Carlo orbit integration method has previously been used when only the planets Jupiter and Saturn were included. With addition of the effects of Uranus and Neptune on the comet orbits, a newly developed Monte Carlo random walk method will be used which is estimated to be about one hundred times faster. This method involves adding random perturbations chosen from a population whose distribution has the proper shape for the problem at hand. Both the total energy of the comet orbits and the perihelion distance will be studied. Dissipation of comets by reason of the sun's heat will be included.

Prior support was by NSF grant AST 74-04860 A01.

SUPPORTED BY U.S. Natl. Science Foundation

10.0006, STELLAR PARALLAXES AND PROPER MOTION
W.F. VANALTENA, Yale University, Graduate School, *New Haven, Connecticut* 06520 (AST76-81339)

A program of astrometric research, with increasing emphasis on southern hemisphere coverage, will be continued. The determination of stellar parallaxes and proper motions by astrometric methods furnishes basic data important to other areas of astronomy. A star's distance from parallax measures, permits finding the true brightness of the star and its position in space. The motions, from a comparison of stellar positions made with an interval of several years between observations, help to determine the sun's path among the stars and its position within our galaxy. The yardstick for all cosmic distances ultimately depends on these astrometic researches.

Over the next three years the Yale investigators will work to reduce the deficiency of astrometric observations in the southern skies. Completion of the Yale Southern Proper Motion Program first epoch observations in Argentina, and an extension of the overlap with the Lick Observatory Northern Program, will be given top priority. Stellar parallax determinations, in part from early Yale observation in South Africa, will be undertaken. Membership determinations in southern star clusters from proper motion studies will be undertaken with the Yale astrometric telescope at Cerro Tololo Inter-American Observatory in Chile. A continuing effort will be made towards improving astrometric instrumentation and deriving all relevant positional information from photographic images to better utilize existing and future plate materials.

Prior support was by NSF grant AST 75-13512.

SUPPORTED BY U.S. Natl. Science Foundation

10.0007, STUDIES OF LONG PERIOD VARIABLES
L.A. WILLSON, Iowa State Univ. of Sc. & Tech, Graduate School, *Ames, Iowa* 50010 (AST76-12162)

A program of monitoring of long period variable stars is presently underway at the Erwin W. Fick Observatory. These observations will be continued, and theoretical models will be constructed to explain these and other existing observations. Support for this project will be made in order to improve the observing equipment, carry out the necessary data processing, and to carry out the theoretical calculations of the relevant atmospheric models.

SUPPORTED BY U.S. Natl. Science Foundation

10.0008, THE EVOLUTION OF NON-THERMAL RADIO SOURCES

W.A. DENT, Univ. of Massachusetts, School of Arts & Sciences, *Amherst, Massachusetts* 01002 (AST76-06808 A01)

The quasi-stellar radio sources exhibit rapid changes in energy output and source structure. Very long baseline interferometry (VLBI) measurements of some of the rapid changes imply a propagation faster than the speed of light if the sources are as far away as they are thought to be. Variable radio source monitoring programs will be conducted at 7.8 GHz and 15.5 GHz on the 120-foot Haystack antenna, at 31.4 GHz and 85.2 GHz on the 36-foot NRAO millimeter wave antenna, and at 2.7 GHz on the NRAO 300-foot antenna. Flux density measurements will be continued to measure regularly the changes in variable source polarization at 2.7 GHz with the NRAO 300-foot antenna, and at 14.5 GHz with the University of Michigan 85-foot antenna.

These data will be used to study the long-term evolution of quasi- stellar objects, to investigate physical models of radio source outburst, to search for correlations with variations at optical frequencies, and to help resolve the controversy over the interpretation of the observed rapid changes in source structure obtained from VLBI interferometry.

This action provides additional funding and extends the duration of the grant number AST77 O7834 for 12 months.

SUPPORTED BY U.S. Natl. Science Foundation

10.0009, PHYSICS OF THE SOLAR ATMOSPHERE

R.C. ALTROCK, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249430)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions of AF communications and detection systems. Objective - determine the environment for solar activity and improved predictions of geophysical disturbances. How research contributes - this work unit addresses the basic processes that lead up to solar flares and seeks an understanding of these mechanisms. This understanding is needed to provide accurate and timely forecasts of solar activity for AF systems that depend upon the propagation of electromagnetic energy.

Mechanisms responsible for the sun's activity originate deep within the sun where magnetic fields are generated by large-scale material motions. These mechanisms, which are poorly understood, are believed to lead to the formation of coronal holes, and solar flares, and subsequent geophysical disturbances which affect Air Force communications and surveillance systems. Observational and theoretical studies of these phenomena will be undertaken. Definitions of the basic magnetic field configuration and energy transport will be attempted using as tools the diode array and universal birefringent filter at the vacuum tower telescope. Comparisons between observed magnetic, convective, and radiative field configurations will be made against theoretical models of energy transport in both the quiet and disturbed regions of the solar atmosphere. A search will be undertaken for large-scale convective motions (giant cells) on the sun, and if they are found, their relations to solar activity will be investigated.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0010, DIRECT OBSERVATIONS OF SOLAR PARTICLES AFFECTING THE COMMUNICATIONS ENVIRONMENT

K.G. YATES, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248900)

AF function - survivability, solar effects on satellite and missile operations, detection, surveillance, and communications. Deficiency - inability to satisfactorily describe and accurately predict solar and precipitation particle events which affect the aerospace environment in which USAF systems operate. Objective - provide direct and timely information on the energetic particles, primarily protons which approach or enter the AF spacecraft and communications environment. Develop techniques for near real-time processing of these data for use as input for solar forecasting. Add data to the data base or catalog of events in order to better define the environment and to add to our understanding of the physical processes involved. During FY77 the SOLRAD 11 satellite will be the basis of the observational program. Improved instrumentation will be developed for future satellites. How research contributes - will provide solar particle data required for definition of aerospace environment. In addition to providing data to environmental forecasters, data will be analyzed to identify critical parameters required to improve the definition of the aerospace environment and the effects of solar radiation on it. Energetic particles accelerated at the sun propagate through the interplanetary medium, impinge on the atmosphere and significantly affect the E.M. propagation via the ionosphere. Current knowledge and prediction techniques are insufficient to accurately predict solar particle outbursts and their effects on the aerospace environment.

Satellite-borne instrumentation has been designed and is providing solar-particle observations which will be analyzed to identify critical parameters required to improve the definition of the aerospace environment and the effects of solar radiation on it. The data will also be made available to environmental forecasters.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0011, ANALYSIS OF SOLAR WIND DATA IN SUPPORT OF THE INTERNATIONAL MAGNETOSPHERIC STUDY

A.J. LAZARUS, Mass. Inst. of Technology, Center For Space Research, *Cambridge, Massachusetts* 02139 (ATM76-82108)

This grant is for the purchase of a computer display terminal and processor, and associated receiver/transmitter. This equipment will be used with time-sharing computers in support of real time analysis of solar wind data received from the Naval Research Laboratory's SOLRAD 11A and 11B satellites.

Specifically, the equipment will enable the investigator, Dr. A. Lazarus, MIT, to: 1) provide an interface with NOAA in order to monitor the solar wind data sent to NOAA to ensure their reliability; 2) implement a program to identify the flow angle of the wind so that data taken in interplanetary space can be distinguished from magnetospheric data; 3) develop data displays which would make solar wind data more useful to the scientific community during the International Magnetospheric Study (IMS).

SUPPORTED BY U.S. Natl. Science Foundation

10.0012, CORONAL HOLE MODEL STUDY

G.L. WITHBROE, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (DF248110; F19628-76-C-0281)

AF function - communications and navigation. Deficiency - communication fading, and timing errors. Objective - to model the solar source regions (coronal holes) of the high-speed solar wind streams which create disruptive geomagnetic disturbances. How research contributes - provides a quantitative measure of the mass and energy flow from the solar atmosphere which form the high-speed solar winds and degrade satellite sensors, satellite and ground-based communications systems, and decrease accuracies of navigation systems.

Radio, EUV and X-ray wavelength solar observations will be used as input parameters for generating models of the coronal holes. The temperature and density profile from chromospheric levels to coronal levels will be derived to determine gradients which provide a measure of the energy transfer. The association of coronal holes with recurrent geomagnetic storms will be examined.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0013, COSMIC-RAY CHARGE AND ISOTOPE STUDIES USING SUB-NANOSECOND TIMING TECHNIQUES

W.R. WEBBER, Univ. of New Hampshire, School of Liberal Arts, *Durham, New Hampshire* 03824 (AST72-05171 A02)

A new balloon instrument to measure the charge and isotope ratios of cosmic rays has been constructed and successfully flown. During the next year, reduction and analysis of the data will be accomplished.

This is a continuation of research originally supported under NSF grant AST 72-05171 (GP-39475).

SUPPORTED BY U.S. Natl. Science Foundation

10.0014, A DEEP SPECTRAL SURVEY OF THE LARGE AND SMALL MAGELLANIC CLOUDS

A.G. PHILIP, Dudley Observatory, *Albany, New York* 12208 (AST76-11431)

A deep spectral survey to 16th apparent visual magnitude has been made of stars in the Large and Small Magellanic Clouds with the new thin prism attached to the Michigan Curtis Schmidt telescope at Cerro Tololo Inter-American Observatory. Stars in the spectral interval O to late F will be classified. The appearance of the spectra will identify the high-luminosity stars present. A catalogue of the stars studied will be published. The new catalogue will incorporate the older principal catalogues, and will correct errors in them. This survey goes about 2 1/2 magnitudes fainter, which is about a factor 10 fainter than any previous spectral survey. This survey will remain as the standard for quite some time. Studies of these stars in the Magellanic Clouds which are our nearest neighboring galaxies will yield information concerning galactic structure, stellar evolution and chemical composition.

SUPPORTED BY U.S. Natl. Science Foundation

10.0015, RAPID OPTICAL VARIATIONS FROM COMPACT STARS

E.L. ROBINSON, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (AST76-23882)

A program of observations of rapid periodic luminosity variations in white dwarfs will be extended to include other aspects of rapid optical variations from compact objects. Photometric observations of non-periodic variations (with time scales between a few milliseconds and a few minutes) of white dwarfs and their accretion disks in nova and nova-like variables will be made. Observations will also be made of the periodic optical variations produced by neutron stars in radio pulsars and binary X-ray pulsars. The observational techniques will be extended to include high-speed spectroscopy as well as high-speed photometry. These observations will be carried out in order to obtain information on the observational characteristics of the rapid optical variations of these objects, on the physical mechanism producing the rapid variations, and on the structure of the compact object.

SUPPORTED BY U.S. Natl. Science Foundation

10.0016, THE RELATIONSHIP OF MACROTURBULENCE TO CHROMOSPHERES IN EARLY- AND LATE-TYPE STARS

M.A. SMITH, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (AST76-08471)

It has become widely accepted during the last two decades that chromospheres and coronas are associated with F, G, and K stars. Studies suggest that the corona evaporates and produces a 'stellar wind.' This wind carries magnetic plasma into interstellar space and exerts a torque on the star, thereby braking its rotation on a time scale of nearly one billion years. A significant related discovery was that the width of one of the primary chromospheric indicators, the reversal of the calcium II K-line, was correlated with the star's absolute visual magnitude. Our sun also fits an extension of this correlation, the Wilson-Bappu effect. Further, information about the solar chromosphere, corona, and the solar wind is consistent with this 'spin-down' picture derived from stellar observations. The onset of these chromosphere phenomena coincides with the development of an extensive stellar convective envelope. To the astronomical spectroscopist this convection manifests itself as 'macroturbulence', or photospheric turbulent or streaming motions over a large scale length. This research is designed to study the relationship between macroturbulence and chromospheric activity. High-resolution digicon observations of sharp-lined stars of different kinds will be made. Fourier deconvolution techniques will be used to separate the rotational and macroturbulent velocity fields. The size and character of the photospheric macroturbulent field will then be compared to various chromospheric indicators. The work will provide added insight to our understanding of the behavior and evolution of stellar atmospheres for solar-type stars.

SUPPORTED BY U.S. Natl. Science Foundation

10.0017, PECULIAR CENTRAL STARS OF PLANETARY NEBULAE

J.H. LUTZ, Washington State University, School of Arts & Sciences, *Pullman, Washington* 99163 (AST75-10353 A01)

Some planetary nebulae have peculiar central stars which are apparently too cool to be responsible for the observed ionization of the nebular shell. A spectroscopic survey of known and suspected peculiar central stars has been carried out and, from the results of the survey, six peculiar objects have been selected for detailed analysis. High- dispersion spectroscopy of these six peculiar objects will be made. The distances to these stars will be determined. The high-dispersion spectra will be used to determine electron densities, temperatures and chemical abundances in the nebulae. This study of the spectra and distances of the peculiar central stars will yield information about the role of planetary nebulae in stellar evolution. This is a renewal of NSF Grant AST 75-10353.

SUPPORTED BY U.S. Natl. Science Foundation

10.0018, DEVELOPMENT OF INFRARED ARRAY SPECTROMETER SYSTEMS

R.D. GEHRZ, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (AST76-05039 A01)

Observations at infrared wavelengths in combination with radio, millimeter and visible studies are rapidly adding to our knowledge of a variety of objects in the universe. An array of six infrared detectors has been used to improve the efficiency of observing the inherently weak infrared signals.

A program of further development of array detectors on spectrometer systems will be carried out. The number of detectors will be increased and the wavelength coverage will be expanded. The resulting instruments will be tested at Kitt Peak National Observatory and will be the main auxiliary instruments to be used on the University of Wyoming 90-inch infrared telescope which is currently under construction.

This is a continuation of work currently supported under NSF grant AST 76-05039.

SUPPORTED BY U.S. Natl. Science Foundation

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01 AERONAUTICS (GENERAL)

N77-25054* + National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 82, APRIL 1977
Apr. 1977 102 p
(NASA-SP-7037(82)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 311 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1977. Author

N77-25055# Advisory Group for Aerospace Research and Development, Paris (France).
INTEGRITY IN ELECTRONIC FLIGHT CONTROL SYSTEMS
Apr. 1977 367 p
(AGARD-AG-224; ISBN-92-835-0192-6) Avail: NTIS HC A16/MF A01

Flight control systems are described for aircraft safety and reliability. Primary, automatic, and manual controls are discussed. For individual titles, see N77-25056 through N77-25079.

N77-25056# Systems Technology, Inc., Hawthorne, Calif.
A HISTORICAL PERSPECTIVE FOR ADVANCE IN FLIGHT CONTROL SYSTEMS **c08**
Duane McRuer and Dunstan Graham (Princeton Univ., New Jersey) *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 7 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

The history of flight control systems is discussed emphasizing early development of theory and practice and automatic control. Several early control approaches are described, showing improvements and changes in the onset of aircraft control systems. M.C.F.

N77-25057# Sperry Flight Systems, Phoenix, Ariz.
CHRONOLOGICAL OVERVIEW OF PAST AVIONIC FLIGHT CONTROL SYSTEM RELIABILITY IN MILITARY AND COMMERCIAL OPERATIONS **c08**
S. S. Osder *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 17 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

Flight control system mechanization advances are traced from the perspective of reliability. Despite dramatic advances in device technology and miniaturization, the demand for more functions tended to exceed the progress in electronics. By the latter 1960's, complexity growth related to system monitoring and redundancy management reached limitations of analog technology and set the stage for introduction of digital flight control systems. Author

N77-25058# Civil Aviation Authority, Redhill (England).
SAFETY CRITERIA FOR FAIL-OPERATIONAL AUTOLAND SYSTEMS AND THEIR APPLICATION **c08**
D. V. Warren *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 9 p ref (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

The airworthiness requirements for the certification of automatic landing systems in civil aircraft include an explicit statement of the safety level to be achieved. For compliance with these requirements, a safety assessment of the system must be made, and accepted by the airworthiness authority. It must contain a logical analysis which identifies all critical failure conditions of the system and shows that the probability of each is appropriate to the degree of hazard associated with it. It should also examine the factors which influence the performance of the system and show by means of analysis, simulation, and flight testing that the safety level will be acceptable. The analysis will establish the maintenance checks necessary together with their frequency, and any other limitations on the use of the system. Author

N77-25059# Boeing Co., Wichita, Kans.
FUTURE TRENDS IN HIGHLY RELIABLE SYSTEMS **c08**
James I. Arnold *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 14 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

The need for highly reliable flight control systems in both control configured vehicles and conventionally designed aircraft is discussed. Technology trends in the area of control system computation, electronics, sensors and actuation are addressed. Increased use of digital computation and signal multiplexing in future control systems is considered inevitable. Recent technology developments in high density electronic packaging, large scale integration, and fiber optics will be applied to achieve highly reliable electronic systems. Component designs will be required to withstand potentially severe environments in the presence of lightning or nuclear phenomena. Redundancy management will continue to be a prime driving force in reliable system designs. The use of in-line monitoring to limit the proliferation of redundant channels should find application in future systems. Maintenance and preflight self-test systems will play an increasingly vital role in assuring the integrity of redundant flight-critical systems. Author

N77-25060# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
A SURVEY OF DESIGN METHODS FOR FAILURE DETECTION IN DYNAMIC SYSTEMS **c38**
Alan S. Willsky *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 14 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

A number of methods for the detection of abrupt changes (such as failures) are surveyed in stochastic dynamical systems. The class of linear systems is concentrated, but the basic concepts, if not the detailed analyses, carry over to other elements of systems. The methods range from the design of specific failure-sensitive filters, to the use of statistical tests on filter innovations, to the development of jump process formulations.

Tradeoffs in complexity versus performance are discussed.
Author

N77-25061# Ultrasystems, Inc., Irvine, Calif.
CAST: A COMPLEMENTARY ANALYTIC-SIMULATIVE TECHNIQUE FOR MODELING COMPLEX, FAULT-TOLERANT COMPUTING SYSTEMS **c61**
R. B. Conn, P. M. Merryman, and K. L. Whitelaw *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 27 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

The complementary analytic-simulative technique (CAST) evolved as it became evident that neither analysis nor simulation alone could satisfy the evaluation requirements of complex computer systems. Analytic modeling provides flexibility and rapid, economical data generation. Simulation permits computer system details to be included easily, but extensive data generation is slow and expensive. CAST permits the user to obtain the best features of both analytic modeling and simulation. CAST is based on the desirability of accurately modeling complex computer systems, utilizing closed-form mathematical expressions for the computer system failure probability. This is achieved through the use of analytic models which utilize parameters determined both by simulation and engineering characterization of the computer system. Author

N77-25062# Polytechnic Inst. of New York, Brooklyn. Div. of Computer Science.
SOFTWARE RELIABILITY: ANALYSIS AND PREDICTION **c38**
Martin L. Shooman *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 17 p refs (For primary document see N77-25055 16-01)
(Contract N00014-67-A-0438-0013)
Avail: NTIS HC A16/MF A01

The types and causes of software errors are described, which provides working definitions of software errors and software reliability. Some of the basic data on frequency of occurrence of errors are discussed. Some of the software reliability models which were proposed are summarized. This newly developed probabilistic model predicts reliability based on the initial number of errors in a program, the number removed, and the number remaining in the program. The model constants are calculated from operational test data taken on the software performance.
Author

N77-25063# Marconi-Elliott Avionic Systems Ltd., Rochester (England). Flight Controls Div.
SOFTWARE INTEGRITY THROUGH VISIBILITY **c38**
G. Belcher and T. Egan *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 6 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

Visibility in the construction, testing and safety analysis of flight control systems is discussed. A computer readable single source software specification which allows information to be retrieved in a more automated manner is used to improve the visibility. A test structure that can display a complete correlation between control functions as specified and as implemented also increases the visibility of the test results. A data flow analysis based on a complete cross reference and symbol table is used as the basis of a method for increasing the visibility of the dormant and common mode failure analysis. Author

N77-25064# IBM Watson Research Center, Yorktown Heights, N.Y.
TECHNIQUES FOR MICROPROGRAM VALIDATION **c61**
W. C. Carter, H. A. Ellozy, W. H. Joyner, Jr., and G. B. Leeman, Jr. *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 19 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

A method for computer-assisted verification of systems controlled by microcode is presented, with examples of its application to actual implementations. Such systems may be a computer with operations emulated by microcode action on a simple processor or a microprocessor coded to perform a fixed task. The specifications for such a design and those for the processor on which it is to be implemented are both described formally, with the code to be certified supplied as data to the low-level description. Informally, corrections of the implementation means that if the specification description and the machine description begin computation with identical inputs, they will get identical results. An interactive system of programs for carrying out mathematical proofs of a formalization of this correspondence has been written. Its application-independent monitor provides a framework for a goal-directed attack on the problem, allowing the user to reduce it to subproblems; programs are invoked to perform symbolic interpretation of the descriptions, generation of sufficient conditions for correctness, theorem proving, and simplification. This system is running and was used to detect and correct errors in an actual microcode implementation; preliminary results of these experiments are described. Author

N77-25065# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
SYSTEM INTEGRITY BY USE OF SELFDIAGNOSING FAILURE DETECTION **c38**
R. Onken *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 18 p (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

A definition of the system integrity function is given in order to enable comparative evaluation of different design approaches for digital flight control systems with respect to the system integrity and mission survival. Two main failure detection methods are analytically investigated with respect to the integrity function, the passive failure detection and the selfdiagnosing active failure detection. The HFB 320 experimental system is briefly described as an example of the selfdiagnosing active failure detection method. Author

N77-25066# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
FAILURE SELF-DETECTION IN DIGITAL FLIGHT GUIDANCE SYSTEMS **c08**
H. Drtil and W. Meyer *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 7 p (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

Procedures for detecting failures in the hardware of the signal processing are developed. This failure self-detection is carried out by means of suitable test programs, and it is supervised by an external supervisor. The design of this supervisor is based on the principle of a watch-dog-timer. Two supervisor systems are developed on the basis of this principle. The improved version allows, in addition, the execution of nominal/actual value comparisons in the supervisor, and this increases the failure self-detection probability. The possible applications of the failure self-detection are discussed. Author

N77-25067# Boeing Co., Houston, Tex.
SNEAK CIRCUIT ANALYSIS APPLICATION TO CONTROL SYSTEM DESIGN **c08**
Joe L. Wilson and Robert C. Clardy *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 6 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

The development and application of a circuit analysis technique is presented. The technique is based on an aerospace discovery that topological criteria exist that can be used to recognize unplanned operational modes of a circuit. The analysis technique involves encoding circuitry data from detailed schematics for computer processing. The computer processing produces simplified, topological network trees which represent the system circuitry. The network trees are analyzed by the application of sneak circuit conditions. The results obtained from a variety of complex electrical systems analyses are also presented as positive collaboration for this circuitry analysis technique. Author

N77-25068# Honeywell, Inc., St. Louis Park, Minn.
BUILT-IN TEST TECHNIQUES FOR DIGITAL FLIGHT CONTROL SYSTEMS **c08**
W. A. Plice *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 13 p refs (For primary document see N77-25055 16-01)

Avail: NTIS HC A16/MF A01

The techniques discussed are suitable for use while the flight control system is performing its normal task. Most of these techniques are also applicable on the ground. Since many inputs and outputs of a digital flight control system are analog signals, some analog testing capability is required. The basic concepts of analog testing may often be carried into digital testing. It is shown that stimulated monitoring is possible where the item under test is time multiplexed or where the stimulus can be designed to have a negligible effect on the system performance. Author

N77-25069# Wales Univ. Inst. of Science and Technology, Cardiff.

PRE-FLIGHT DYNAMIC CHECKOUT **c08**

D. R. Towill *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 15 p refs Sponsored by the UK Ministry of Defence and the UK Sci. Res. Council (For primary document see N77-25055 16-01)

Avail: NTIS HC A16/MF A01

The advent of Fast Fourier Transform algorithms coupled to the increasing availability of data processing facilities has resulted in transfer function testing increasing enormously in popularity. System impulse response, step response, or frequency response are all satisfactory dynamic signatures related to the transfer function of the system under test. It is sufficient for many pre-flight checkout applications to estimate the signature at just a few carefully selected data points, thus considerably reducing test time and computational capacity required. This in turn permits the use of special purpose hardware such as Fourier Response Analyzers when justified on cost-benefit or logistic grounds as an alternate to spectral analysis methods. The basic ground rules for selecting system test stimuli and test features for both manual and automatic testing are provided. Author

N77-25070# Northrop Corp., Norwood, Mass. Dept. of Precision Products.

THRESHOLDLESS REDUNDANCY MANAGEMENT WITH ARRAYS OF SKEWED INSTRUMENTS **c38**

J. E. Potter and M. C. Suman *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 25 p refs (For primary document see N77-25055 16-01)

Avail: NTIS HC A16/MF A01

The design and implementation of redundant instrument systems are discussed, which provides a basis for further work on practical thresholdless fault-tolerance. A worst-case performance index is developed which requires no knowledge about the statistics of the instrument errors. It is shown that the least squares estimator minimizes this index, but that the resulting algorithm is not fault-tolerant. A fault-tolerant algorithm is then defined which uses the worst-case performance index to bound the estimation error by the product of the index and the RSS of the individual instrument errors with the largest error ignored; the algorithm chooses as the estimate the value which minimizes the worst-case index. Numerical results indicate that useful error bounds are realized. Author

N77-25071# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

TIME-DIVISION MULTIPLEXED DATA BUS INTEGRATION TECHNIQUES **c06**

Erwin C. Gangel *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 9 p refs (For primary document see N77-25055 16-01)

Avail: NTIS HC A16/MF A01

Today, avionics are demanding an increasing proportion of the resources available for aircraft weapons systems. These avionics are providing increased capability and accuracy to the aircraft weapon system but, also are a prime contributor to increased complexity and decreased reliability of the system. Digital avionics appear to offer the desired increase in capabilities and performance without the normal companions of low reliability, complexity, and high cost because it is amenable to mechanization via solid state devices; it is more orderly and systematic, and provides growth and change without major hardware modification. Digital avionic integration, in order to reap these benefits, requires standard equipment interfaces and a standard approach to data intercommunication. The time division data bus is the technique that permits this new concept of system integration to emerge. The data bus evolutions, its standardization and application are presented. The acquisition management and logistic benefits are discussed. Author

N77-25072*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HIGHLY RELIABLE MULTIPROCESSORS **c62**

Nicholas D. Murray, Albert L. Hopkins (Charles Stark Draper Lab., Inc.), and John H. Wensley (Stanford Res. Inst., Menlo Park, Calif.) *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 17 p refs (For primary document see N77-25055 16-01)

Avail: NTIS HC A16/MF A01

Highly reliable fault-tolerant computer systems are discussed for use in flight-critical avionic and control systems of future commercial transport aircraft. Such aircraft are envisioned to have integrated systems, to be terminally configured, and to be equipped with fly-by-wire flight control systems, all of which require highly reliable, fault-tolerant computers. Two candidate computer architectures are identified as having the potential of satisfying the commercial transport aircraft requirements. Author

N77-25073# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Control Systems Development Branch.

OBJECTIVES FOR THE DESIGN OF IMPROVED ACTUATION SYSTEMS **c08**

B. H. Earley *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 16 p refs (For primary document see N77-25055 16-01)

Avail: NTIS HC A16/MF A01

Actuation system reliability is particularly critical to the success of modern Flight Control System (FCS) techniques which utilize high authority electrical controls. The reliability combined with typical performance requirements have a substantial effect on the actuator resulting in a high level of sophistication, complexity, attendant high cost, and reduced maintainability. A description of actuation systems evolution and several redundant system approaches are included. Significant redundant system criteria are discussed followed by a series of design objectives pertinent to relief of typical actuator problems. A basic design approach is also recommended to assure timely integration of the FCS in the vehicle design process and proper interfacing of the primary technical disciplines. The implementation and benefits of actuation system development programs are discussed, and several new actuation concepts are mentioned. Author

N77-25074# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

F-16 FLIGHT CONTROL SYSTEM DEVELOPMENT **c08**

David L. Carleton *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 9 p refs (For primary document see N77-25055 16-01)

Avail: NTIS HC A16/MF A01

The purpose of this paper is to outline development procedures required to implement the fly-by-wire flight control system in the F-16 aircraft. Several developmental efforts were required to implement the flight control system into the aircraft. These efforts include the design and development of specific hardware, including the sensors, actuators, and the flight control computer itself. Once the subsystems were developed, the process of integration and definition of the flight control system became a developmental effort. Once the hardware was integrated into the aircraft, the developmental effort then swung towards on-aircraft tests to ensure that the flight control system was compatible with the airframe within the operational flight envelope. Once these ground tests were completed, the development effort then concentrated on the flight test portion of the program where the flight control system was optimized precision tracking in the air superiority and ground attack role. The F-16 flight control system development was rather unique inasmuch as it was a two-fold effort. A development effort was undertaken to ensure that the prototype aircraft could indeed meet the safety of flight requirements, and then the effort swung towards full scale development of the fly-by-wire flight control system for a production aircraft application. The process is illustrated to expand upon the development process and show how the various steps

interact. It also demonstrates the iterative nature of the process. Author

N77-25075# Honeywell, Inc., St. Louis Park, Minn. Government and Aeronautical Products Div.
JA-37 DIGITAL AUTOMATIC FLIGHT CONTROL SYSTEM (DAFCS) **c08**
D. G. Bailey and Kjell Folkesson (SAAB SCANIA, Linkoping, Sweden) *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 11 p (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

Adequate in-flight fail safety was verified by demonstrating that the in-flight monitoring function was extremely effective in detecting potentially catastrophic failure modes. (Potentially catastrophic failure modes are those that produce transients in excess of specified limits.) Effectiveness in detecting potentially catastrophic failure modes was demonstrated to be well above 99 percent. Overall fault detection, including potentially catastrophic as well as non-catastrophic failure modes, was closer to 97 percent. The effectiveness of the in-flight monitoring function was demonstrated to be compatible with the allowable one millionth catastrophic failure probability for a 90-minute mission. Author

N77-25076*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
DESIGN AND TEST EXPERIENCE WITH A TRIPLY REDUNDANT DIGITAL FLY-BY-WIRE CONTROL SYSTEM **c08**
Kenneth J. Szalai, Philip G. Fellemen (Charles Stark Draper Lab., Inc.), Joseph Gera (NASA Langley Res. Center), and Richard D. Glover (NASA Johnson Space Center) *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 30 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

A triplex digital fly-by-wire flight control system was developed and then installed in a NASA F-8C aircraft to provide fail-operative, full authority control. Hardware and software redundancy management techniques were designed to detect and identify failures in the system. Control functions typical of those projected for future actively controlled vehicles were implemented. The principal design features of the system, the implementation of computer, sensor and actuator redundancy management, and the ground test results are described. An automated test program to verify sensor redundancy management software is also described. Author

N77-25077# Lockheed-California Co., Burbank.
L-1011 FLIGHT CONTROL SYSTEM **c08**
J. A. Flapper and E. O. Throndsen *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 24 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

The L-1011 flight controls-primary and automatic-are described which are of interest because of the state of the art advancements and the improvements which they represent. The flying tail primary control system, its rationale and design features are dealt with in some detail. Integration of primary controls with automatic flight controls is treated and the direct lift control system and roll control briefly described. The automatic controls are described with emphasis on the yaw stability augmentation system and the automatic landing system. The former is in concept an active control system in that design loads are predicated on its availability. The latter, for the final stage of landing in Category 3 conditions, is the forerunner of the fly by wire concept for commercial transports. System rationale or design features which enhance safety and reliability are treated. Author

N77-25078# Aerospatiale Usines de Toulouse (France).
FLIGHT CONTROLS FOR THE CONCORDE [LES COMMANDES DE VOL DE CONCORDE] **c08**
M. Bossard and R. Deque *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 12 p In FRENCH (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

A description of various flight controls for Concorde is presented. System components are listed, and performance characteristics are discussed. Electrical flight systems based on the utilization of digital techniques which can be applied to supersonic transport aircraft of second generation were briefly evaluated. Transl. by B.B.

N77-25079# Royal Aircraft Establishment, Farnborough (England). Dept. of Flight Systems.
A HIGH-RELIABILITY, HIGH INTEGRITY FLIGHT CONTROL SYSTEM FOR HELICOPTERS **c08**
P. Robinson, J. Mesdows (Smiths Industries Ltd., Gloucestershire, Engl.), and C. M. Copage (Smiths Industries Ltd., Gloucestershire, Engl.) *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 15 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

Some of the operations which helicopters may be required to carry out at night and in poor visibility are briefly described. Because of the high pilot work load likely to arise in these situations, it is argued that the helicopter should be equipped with an autostabilization system having a defect-survival capability. One system to meet this requirement, together with quantitative system reliability and integrity requirements, was developed and manufactured for a Sea King helicopter. This system is triplex, with digital computation, and has the development potential to include autopilot facilities, more sophisticated control techniques, and extended system redundancy. The redundancy philosophy and the approach to assessment of system reliability and integrity are described, together with salient design and engineering details of the system. Also an indication is given of future trends in the technology. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N77-25080*# Systems Research Labs., Inc., Newport News, Va. Rasa Div.
WIND TUNNEL TESTS OF A TWO BLADED MODEL ROTOR TO EVALUATE THE TAMI SYSTEM IN DESCENDING FORWARD FLIGHT
Richard P. White, Jr. May 1977 53 p refs
(Contract NAS1-14129)
(NASA-CR-145195; SRL-14-76-2) Avail: NTIS HC A04/MF A01 CSCL 01A

A research investigation was conducted to assess the potential of the Tip Air Mass Injection system in reducing the noise output during blade vortex interaction in descending low speed flight. In general it was concluded that the noise output due to blade vortex interaction can be reduced by 4 to 6 db with an equivalent power expenditure of approximately 14 percent of installed power. Author

N77-25081*# Texas A&M Univ., College Station.
TRANDES: A FORTRAN PROGRAM FOR TRANSONIC AIRFOIL ANALYSIS OR DESIGN Final Report
Leland A. Carlson Jun. 1977 111 p refs
(Grant NsG-1174)
(NASA-CR-2821) Avail: NTIS HC A06/MF A01 CSCL 01A

A program called TRANDES is presented that is used for the analysis of steady, irrotational transonic flow over specified two-dimensional airfoils in free air or for the design of airfoils having a prescribed pressure distribution, including the effects of weak viscous interaction. Instructions on program usage, listings of the program, and sample cases are given. Author

N77-25082*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.
METHOD FOR OBTAINING AERODYNAMIC DATA ON HYPERSONIC CONFIGURATIONS WITH SCRAMJET EXHAUST FLOW SIMULATION Final Report
William R. Hartill Washington NASA Jun. 1977 76 p refs
(Contract NAS1-14320)
(NASA-CR-2831; NA-76-752) Avail: NTIS HC A05/MF A01 CSCL 01A

A hypersonic wind tunnel test method for obtaining credible aerodynamic data on a complete hypersonic vehicle (generic X-24c) with scramjet exhaust flow simulation is described. The general problems of simulating the scramjet exhaust as well as accounting for scramjet inlet flow and vehicle forces are analyzed, and candidate test methods are described and compared. The method selected as most useful makes use of a thrust-minus-drag flow-through balance with a completely metric model. Inlet flow is diverted by a fairing. The incremental effect of the fairing is determined in the testing of two reference models. The net thrust of the scramjet module is an input to be determined in large-scale module tests with scramjet combustion. Force accounting is described, and examples of force component levels are predicted. Compatibility of the test method with candidate wind tunnel facilities is described, and a preliminary model mechanical arrangement drawing is presented. The balance design and performance requirements are described in a detailed specification. Calibration procedures, model instrumentation, and a test plan for the model are outlined. Author

N77-25083*# Wichita State Univ., Kans.
FORCE AND PRESSURE TESTS OF THE GA(W)-1 AIRFOIL WITH A 20% AILERON AND PRESSURE TESTS WITH A 30% FOWLER FLAP
W. H. Wentz, Jr., H. C. Seetharam, and K. A. Fiscko Washington NASA Jun. 1977 96 p refs
(Grant NsG-1165)
(NASA-CR-2833; WSU-AR-76-1) Avail: NTIS HC A05/MF A01 CSCL 01A

Wind tunnel force and pressure tests were conducted for the GA(W)-1 airfoil equipped with a 20% aileron, and pressure tests were conducted with a 30% Fowler flap. All tests were conducted at a Reynolds number of 2.2 and a Mach number of 0.13. The aileron provides control effectiveness similar to ailerons applied to more conventional airfoils. Effects of aileron gaps from 0% to 2% chord were evaluated, as well as hinge moment characteristics. The aft camber of the GA(W)-1 section results in a substantial up-aileron moment, but the hinge moments associated with aileron deflection are similar to other configurations. Fowler flap pressure distributions indicate that unseparated flow is achieved for flap settings up to 40 deg., over a limited angle of attack range. Theoretical pressure distributions compare favorably with experiments for low flap deflections, but show substantial errors at large deflections. Author

N77-25084*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL PERFORMANCE OF A 16.10-CENTIMETER-TIP-DIAMETER SWEPTBACK CENTRIFUGAL COMPRESSOR DESIGNED FOR A 6:1 PRESSURE RATIO
Hugh A. Klassen, Jerry R. Wood, and Lawrence F. Schumman Jun. 1977 31 p refs
(NASA-TM-X-3552; E-9074) Avail: NTIS HC A03/MF A01 CSCL 21E

A backswept impeller with design mass flow rate of 1.033 kg/sec was tested with both a vaned diffuser and a vaneless diffuser to establish stage and impeller characteristics. Design stage pressure ratio of 5.9:1 was attained at a flow slightly lower than the design value. Flow range at design speed was 6 percent of choking flow. Impeller axial tip clearance at design speed was varied to determine effect on stage and impeller performance. Author

N77-25085*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF WINGLETS ON A FIRST-GENERATION JET TRANSPORT WING. 1: LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A SEMISPAN MODEL AT SUBSONIC SPEEDS
Peter F. Jacobs, Stuart G. Flechner, and Lawrence C. Montoya Jun. 1977 50 p refs
(NASA-TN-D-8473; L-11354) Avail: NTIS HC A03/MF A01 CSCL 01A

Longitudinal aerodynamic characteristics and cross-flow velocity vectors behind the wing tip of a first-generation jet transport semispan model are presented at subsonic speeds. Data are given for the basic wing and configurations with an upper winglet only, upper and low winglets, and a simple wing-tip extension. To simulate second-segment-climb lift conditions, leading- and/or trailing-edge flaps were added to some configurations. Author

N77-25086*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC AND WIND-ON TESTS OF AN UPPER-SURFACE-BLOWN JET-FLAP NOZZLE ARRANGEMENT FOR USE ON THE QUIET CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE)
Arthur E. Phelps, III Jun. 1977 44 p refs
(Da Proj. 1L1-61102-AH-45)
(NASA-TN-D-8476; L-11421) Avail: NTIS HC A03/MF A01 CSCL 01A

The internal aerodynamic performance, the static turning characteristics, and the forward-speed characteristics of two 1/12-scale upper surface-blown jet-flap exhaust-nozzle arrangements designed for use on the Quiet Clean Short-Haul Experimental Engine (QCSEE) were investigated. The nozzles were equipped with interchangeable area-control side doors in the aft sidewalls of the nozzle so that the effective nozzle area could be varied over a wide range. A simulated wing was used to evaluate installation losses for the nozzles. A smoothly curved flap was attached to the trailing edge of the simulated wing to allow an evaluation of the static turning characteristics of the nozzle arrangement. Forward-speed effects on the jet turning characteristics of the QCSEE nozzles were evaluated by mounting a single engine on a semispan wing designed to be representative of a four-engine STOL transport configuration. Author

N77-25087*# Maryland Univ., College Park. Dept. of Aerospace Engineering.
AN EXPERIMENTAL INVESTIGATION OF A TWO AND A THREE-DIMENSIONAL LOW SPEED TURBULENT BOUNDARY LAYER
A. E. Winkelmann and W. L. Melnik Dec. 1976 189 p refs
(Grant NGR-21-002-303; Contracts N00014-75-C-0613; N00014-67-A-0239-0029)
(NASA-CR-153244; TR-AE-76-2) Avail: NTIS HC A09/MF A01 CSCL 01A

Experimental studies of a two and a three-dimensional low speed turbulent boundary layer were conducted on the side wall of a boundary layer wind tunnel. The 20 ft. long test section, with a rectangular cross section measuring 17.5 in. x 46 in., produced a 3.5 in. thick turbulent boundary layer at a free stream Reynolds number. The three-dimensional turbulent boundary layer was produced by a 30 deg swept wing-like model faired into the side wall of the test section. Preliminary studies in the two-dimensional boundary layer indicated that the flow was nonuniform on the 46 in. wide test wall. The nonuniform boundary layer is characterized by transverse variations in the wall shear stress and is primarily caused by nonuniformities in the inlet damping screens. Author

N77-25088*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LASER VELOCIMETER MEASUREMENTS OF TWO-BLADED HELICOPTER ROTOR FLOW FIELDS
James C. Biggers, Albert Lee (AAMRDL, Moffett Field, Calif.), Kenneth L. Orloff, and Opal J. Lemmer (Beam Eng. Inc.) May 1977 158 p refs
(NASA-TM-X-73238; A-7071) Avail: NTIS HC A08/MF A01 CSCL 01A

Data from a wind tunnel investigation of the flow fields around helicopter rotors were presented. A two component laser velocimeter was used to measure the velocity fields of two 2.1 m diameter rotors. A minicomputer-based online data system is described which monitored, reduced, and plotted the results. Tip vortices constitute the primary disturbances in the flow field, but present theories do not predict vortex positions and velocity distributions with sufficient accuracy. Author

N77-25089# Naval Surface Weapons Center, Dahlgren, Va. Advanced Weapons Dept.
THE EFFECT OF BOATTAIL SHAPE ON MAGNUS
Gil Y. Graff and Frank G. Moore Dec. 1976 33 p refs Backup document for AIAA Synoptic, "An Empirical Method for Predicting

the Magnus", scheduled for publication in AIAA Journal in Oct. 1977
(AD-A035273; NSWC/DL-TR-3581) Avail: NTIS HC A03/MF A01 CSCL 19/4

The effects of projectile boattail geometry on the Magnus force and moment were investigated through wind tunnel tests of a 5.2 caliber nonfinned projectile. Boattail length varied from 0 to 1.7 calibers, and boattail angle varied from 0 deg to 18 deg with Mach numbers ranging between 0.5 and 2.5. A Reynolds number of 4 million per foot was chosen to ensure fully developed turbulent flow ahead of the boattail. The Magnus force and moment coefficient derivatives correlate well with a nondimensional variable derived from the Howarth-Mangler transformation. A methodology for calculating the Magnus force and moment coefficient derivatives is developed and shown to compare favorably with the Magnus data of other shells. Author

N77-25090*# Wichita State Univ., Kans.
A LOW SPEED TWO-DIMENSIONAL STUDY OF FLOW SEPARATION ON THE GA(W)-1 AIRFOIL WITH 30-PERCENT CHORD FOWLER FLAP
H. C. Seetharam and W. H. Wentz, Jr. Washington NASA May 1977 73 p refs
(Grant NGR-17-003-021)
(NASA-CR-2844) Avail: NTIS HC A04/MF A01 CSCL 01A

Measurements of flow fields with low speed turbulent boundary layers were made for the GA(W)-1 airfoil with a 0.30 c Fowler flap deflected 40 deg at angles of attack of 2.7 deg, 7.7 deg, and 12.8 deg, at a Reynolds number of 2.2 million, and a Mach number of 0.13. Details of velocity and pressure fields associated with the airfoil flap combination are presented for cases of narrow, optimum and wide slot gaps. Extensive flow field turbulence surveys were also conducted employing hot-film anemometry. For the optimum gap setting, the boundaries of the regions of flow reversal within the wake were determined by this technique for two angles of attack. Local skin friction distributions for the basic airfoil and the airfoil with flap (optimum gap) were obtained using the razor blade technique. Author

N77-25091*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS OF RANDOM INLET PRESSURE FLUCTUATIONS DURING FLIGHTS OF F-111A AIRPLANE
William G. Costakis Washington May 1977 36 p refs
(NASA-TM-X-3540; E-9037) Avail: NTIS HC A03/MF A01 CSCL 01A

Compressor face dynamic total pressures from four F-111 flights were analyzed. Statistics of the nonstationary data were investigated by analyzing the data in a quasi-stationary manner. Changes in the character of the dynamic signal are investigated as functions of flight conditions, time in flight, and location at the compressor face. The results, which are presented in the form of rms values, histograms, and power spectrum plots, show that the shape of the power spectra remains relatively flat while the histograms have an approximate normal distribution. Author

N77-25092*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATION OF PART-SPAN DAMPER LOSSES THROUGH TRANSONIC ROTORS OPERATING NEAR DESIGN POINT
William B. Roberts (Notre Dame Univ., Ind.) Washington Jun. 1977 23 p refs
(NASA-TM-X-3542; E-9068) Avail: NTIS HC A02/MF A01 CSCL 01A

The design-point losses caused by part-span dampers (PSD) were correlated for 21 transonic axial flow fan rotors that had tip speeds varying from 350 to 488 meters per second and design pressure ratios of 1.5 to 2.0. For these rotors a correlation using mean inlet Mach number at the damper location, along with relevant geometric and aerodynamic loading parameters, predicts the variation of total pressure loss coefficient in the region of the damper to a good approximation. Author

N77-25093# Weapons Research Establishment, Salisbury (Australia).
A FORTRAN PROGRAM TO EXTRACT STATIC AND DYNAMIC MOMENTS FROM FREE OSCILLATIONS IN A WIND TUNNEL
R. L. Pope Dec. 1976 42 p refs
(WRE-TN-1729(WR/D)) Avail: NTIS HC A03/MF A01

A FORTRAN program was developed using the parameter estimation technique to extract the static pitching moment and the dynamic pitch damping moment from incidence measurements taken during planar oscillations of a model in a wind tunnel. The advantage of the parameter estimation method of analysis in this particular case is its ability to treat highly nonlinear forms of the static pitching moment. Comparisons are made with other wind tunnel measurements. A listing of the program and a sample run are included. Author

N77-25094# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
A PROGRAM FOR THE COMPUTATION OF A COMPRESSIBLE TURBULENT BOUNDARY LAYER UNDER INFINITE SWEPT WING CONDITIONS
J. P. F. Lindhout and E. DeBoer 30 Jun. 1975 44 p refs
(Contract RNLAF-RB-KLu-1974)
(NLR-TR-75090-U) Avail: NTIS HC A03/MF A01

A method is presented to compute the 3D compressible turbulent boundary layer on an adiabatic wall under infinite swept wing conditions. The mathematical model of turbulence is based on a generalization of Bradshaw's 2D shear stress equation. The method consists of the solution of five nonlinear hyperbolic differential equations valid along five distinct characteristics. A brief discussion is devoted to the choice of a suitable difference scheme. The FORTRAN program is described. Some results of calculations in practical cases are shown and suggest that the program can be applied successfully; however, a more extensive analysis of calculations and measurements is necessary to estimate the abilities of the method. The listing of the program and an example of input/output are obtainable on request.Author (ESA)

N77-25095# Institut Franco-Allemand de Recherches, St. Louis (France).
THE CLASSICAL INTERIOR BALLISTICS THEORIES DEVELOPED IN FRANCE DURING THE FIRST THIRD OF THE 20TH CENTURY, AND THEIR RECENT APPLICATION [LES THEORIES CLASSIQUES DE LA BALISTIQUE INTERIEURE EN FRANCE DANS LE PREMIER TIERS DU 20eme SIECLE ET QUELQUES-UNES DE LEURS APPLICATIONS RECENTES]
A. Carriere 11 Apr. 1975 115 p refs In FRENCH
(ISL-NB-402/75) Avail: NTIS HC A06/MF A01

The two most important interior ballistics theories developed in France, those of Gossot-Liouville and of Charbonnier-Sugot, are presented and discussed. A FORTRAN program is described for calculation of the main interior ballistics parameters according to Charbonnier-Sugot. Results are presented in tables adopting Sugot's presentation. A computation model for gunbarrel projects is proposed, and two examples of application are described.ESA

N77-25096# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
APPLICATION OF PANEL METHODS FOR UNSTEADY SUBSONIC FLOW
R. Roos May 1976 42 p refs Presented at the Euromech Colloq. 75 on Calculation of Flow Fields by Means of Panel Methods, Brunswick, 10-13 May 1976 Sponsored by Air Mater. Directorate of the Roy. Neth. Air Force
(NLR-MP-76010-U) Avail: NTIS HC A03/MF A01

A survey is given of results obtained with two panel methods for the calculation of the aerodynamic loading on oscillating airplane configurations in subsonic flow. The methods involved are: the doublet-lattice method for thin lifting surfaces and the NLRI-panel method for wing-body combinations. After a short outline of each, their merits are discussed in view of practical applications. Some of the latest results, including pressure distributions, load distributions, and dynamic stability derivatives, are given. Finally a simple method is outlined by which unsteady panel methods for thin lifting surfaces may be pushed into the high subsonic speed range through the use of local Mach number corrections. Author (ESA)

N77-25097# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.

THE CALCULATION OF AERODYNAMIC CHARACTERISTICS OF WING-BODY COMBINATIONS AT SUBSONIC FLIGHT SPEEDS

W. Loeve Jun. 1976 11 p refs Presented at the 6th Intern. Conf. on Numerical Methods in Fluid Dyn., Enschede, Neth., 28 Jun. - 3 Jul. 1976

(NLR-MP-76017-U) Avail: NTIS HC A02/MF A01

Surface panel methods and finite difference methods are reviewed with respect to the use in the design of airplanes. It is concluded that there is a need for inverse surface panel type methods to diminish the trial and error character of the design process. Finite difference methods based on transonic small perturbation theory must be based on an equation that is the proper small perturbation of the mass conservation law. The only sensible next step in the development seems to be the solution of the full potential equation applying correct boundary conditions. Author (ESA)

N77-25098# National Aerospace Lab., Amsterdam (Netherlands). Flight Dynamics Div.

REYNOLDS NUMBER EFFECTS ON PRESSURE AND NORMAL FORCE DISTRIBUTIONS ALONG CONICALLY POINTED CIRCULAR CYLINDER AT FREE-STREAM MACH NUMBER OF 2.3

S. J. Boersen 1 Sep. 1975 55 p refs

(NLR-TR-75124-U) Avail: NTIS HC A04/MF A01

Pressure measurements were carried out on five stations along a 7.5 caliber conically pointed circular cylinder. Pressure distributions were integrated to produce local normal force coefficients. Some pitot pressure surveys were performed in the external flow and the surface flow was visualized using an oil technique. For the zero-incidence case Reynolds number effects are absent. At 6 deg incidence all stations show a moderate effect on the pressure distribution along the side of the model. Major effects occur on the forward half of the cylinder. Large Reynolds number effects were found along the entire cylinder for incidences of 9 and 12 deg. The smallest effect was observed on the most downstream station where vortex lift-off starts. The zero-incidence pressure distribution was computed; the agreement with experiment is excellent. Pressure distributions calculated using Woodward's supersonic panelling method exhibit for small incidences a considerable, but virtually constant, difference with experiment; at incidences in excess of 6 deg, the discrepancies become very large. As for the normal force coefficient, the agreement is excellent for small incidences; at 9 deg incidence and larger the normal force coefficient is grossly underestimated. Author (ESA)

N77-25099# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

ON THE NUMERICAL COMPUTATION OF THE SUPERSONIC FLOW FIELD ABOUT BLUNTED CONES AT SMALL ANGLES OF INCIDENCE M.S. Thesis

L. L. VanDommelen and W. J. Bannink Sep. 1976 59 p refs

(VTH-LR-225) Avail: NTIS HC A04/MF A01

The flow field about 7.5 deg semi apex angle blunted cones placed in a Mach 3 supersonic flow at small angles of attack was computed numerically. The bluntness was obtained in two ways: by means of a spherical nose and by means of a 45 deg semi-apex angle. The computations were made by the method of characteristics for axially symmetric flow and by a finite difference approach according to a method of Moretti and Pandolfi. The important features of these methods are discussed and possible improvements suggested. Author (ESA)

N77-25100# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

EXPERIMENTAL INVESTIGATION OF THE SUPERSONIC FLOW FIELD ABOUT A SLENDER CONE AT HIGH INCIDENCES

C. Nebbeling and W. J. Bannink Nov. 1976 59 p refs

(VTH-LR-233) Avail: NTIS HC A04/MF A01

Measurements of the flow distribution around a cone at several angles of attack are reported in order to obtain the velocity distribution in the flow field and therefore regions with flow separation and vortices occurring at high angles of incidence. The experiments were performed using a five hole conical-head probe which measures both the pitot pressure and the flow angularity. For the location of the embedded shock waves the pitot pressure distribution was used. In addition surface flow visualization was made. ESA

N77-25101# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

EFFECT OF PRODUCTION MODIFICATIONS TO REAR OF WESTLAND LYNX ROTOR BLADE ON SECTIONAL AERODYNAMIC CHARACTERISTICS

P. G. Wilby London Aeron. Res. Council 1977 21 p refs Supersedes RAE-TR-73043; ARC-34835

(ARC-CP-1362; RAE-TR-73043; ARC-34835) Avail: NTIS HC A02/MF A01; HMSO £1.50; PHI $5.80

The RAE (NPL) 9615 airfoil was accepted, on the basis of wind tunnel tests, as the basic blade section for the Westland WG 13 Lynx helicopter rotor; however, production methods necessitated a modification to the rear profile of the blades which was considered sufficient to produce changes in the aerodynamic characteristics of the airfoil. Thus, the modified profile was tested in the wind tunnel and the experimental data compared with those for the original profile. The main effects of the modification were found to be a small increase in maximum lift, a small decrease in supercritical drag, and a reduced range of pitching moment coefficient. These changes arise from the generation of a small increment of lift, over the rear of the airfoil, which increases progressively from zero as incidence increases from zero. Author (ESA)

N77-25102# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

THE BEHAVIOR OF A CONICAL VORTEX SHEET ON A SLENDER WING NEAR THE LEADING EDGE

G. J. Clapworthy and K. W. Mangler London Aeron. Res. Council Oct. 1974 36 p refs Supersedes RAE-TR-74150; ARC-35901

(ARC-R/M-3790; RAE-TR-74150; ARC-35901) Avail: NTIS HC A03/MF A01; HMSO £4; PHI $15.30

The inviscid flow field past a slender delta wing at incidence with leading-edge separation can be considered as conical. The shape of the resulting vortex sheet has been calculated previously. Here the behavior of the sheet near the leading edge of the wing is investigated and an expansion of the solution in this neighborhood is found by the application of certain theorems of the theory of complex functions. It is shown that in a cross-flow plane (normal to the undisturbed flow) the slope of the sheet can be expressed in powers of the square root of the arc length measured along the sheet. A related series expansion is found for the strength of the vortex sheet. The sheet is always tangential to the pressure side of the wing. On the suction side of a wing with thickness, the flow is parallel to the leading edge, so that the strength of the vortex sheet at the leading edge is directly related to the overall circulation around the sheet. Author (ESA)

N77-25103# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

WIND TUNNEL HIGH LIFT OPTIMIZATION OF A MULTIPLE ELEMENT AIRFOIL Final Report

B. Ljungstroem 1976 118 p refs

(Contracts F-INK-82223-68-001-07-001; F-INK-82223-69-002-07-001; F-INK-82223-71-302-07-001; F-INK-82223-70-807-07-001; F-INK-82223-72-004-07-001; F-INK-82223-73-009-07-001)

(FFA-TN-AU-778) Avail: NTIS HC A06/MF A01

Wind tunnel tests were carried out with a two-dimensional high lift wing, based on a NACA 652-215 wing section. Three different configurations were tested: basic wing section (with flaps retracted), take-off configuration (with single slotted flap and leading edge slat), and landing configuration (with a double slotted flap and a leading edge slat). The objectives were to optimize the geometry of the configurations for the take-off and the leading case. A large number of parameter variations were made. The best maximum lift result is 5.0 for a 55 deg double slotted flap and a 20 deg leading edge slat. The importance of aerodynamic interaction between the leading edge and the trailing edge was shown clearly. Optimization of the slat position has considerable effect on the flap flow for high angles of attack.

The optimum slat gap was shown to increase rapidly with decreasing slat angle. The optimum first flap gap increases slowly with increasing flap angle and is approximately twice the size of the optimun second flap gap. A similarity between CL maximum lift trends for the present 2-D tests with 3-D tests (18 deg sweep angle AR = 7) is shown. Author (ESA)

N77-25104# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

WING-BODY INTERFERENCE AT MODERATE SUPERSONIC SPEEDS. A COMPARISON BETWEEN PANEL METHOD AND EXPERIMENT Final Report

Erik Larson and Nada Agrell 1976 122 p refs Original contains color illustrations

(Contract F-INK-13-13316)

(FFA-TN-AU-940) Avail: NTIS HC A06/MF A01

A comprehensive inspection of the possibility of obtaining, from the panel method, reliable load distributions and partial load ratios at the side of total normal-force and pitching-moment data in the low angle of attack region for wing-body combinations at moderate supersonic speeds was carried out. Several wing families of different planform in combination with an ogive-cylinder body were investigated. The planforms on the wings range from unswept leading-edge wings to delta wings. The trailing-edge is either swept forward 45 deg or unswept. By means of clipping the wing tips, the planform and the aspect ratio of the wing within a wing family was successively decreased. The computed result was in several cases compared with experiment and the correlation is convincing as long as the linear flow characteristics dominate, which seems to be the case as long as the wing-tips are unclipped. As soon as a side edge is present, the panel method in its present formulation can not give satisfactory results for the load distribution on the body and the corresponding pitching-moment in the first place. For rectangular wing-body combinations of the classical type, it can be concluded that the panel method has added practically nothing as to the possibility of obtaining a reliable load distribution on the body and a corresponding pitching-moment. This is not surprising because the problem of obtaining a realistic downwash field behind the wing is not solvable within linear aerodynamics. The panel method is in this respect a computerized solution of the rectangular wing-body problem, only. From the rich data bank, a number of ratios between partial loads on wing-body combinations were inspected and, in several cases, compared with slender body-theory. Author (ESA)

N77-25105# European Space Agency, Paris (France).

CALCULATION OF FLOW FIELDS WITH SEPARATION BUBBLES AT HIGH REYNOLDS NUMBER

Dieter Geropp et al May 1977 64 p refs Transl. into ENGLISH of 'Berechnung von Stroemungsfeldern mit Ableoeseblasen bei grossen Reynoldszahlen', DFVLR, Karlsruhe, West Ger. Report DLR-FB-76-52, 27 Sep. 1976 Original report in GERMAN previously announced as N77-21056 Original German report available from DFVLR, Cologne DM 25,30

(ESA-TT-378; DLR-FB-76-52) Avail: NTIS HC A04/MF A01

The two-dimensional, steady, incompressible flow around a body is divided into five zones and is idealized: external flow - potential flow; attached flow - boundary layer; dead-air flow - fictive body causing a typical pressure distribution; flow between the bubble and the dead-air - boundary layer; separation bubble - fictive thickening on the body causing a typical pressure distribution. The influence of the dead-air, the bubble, and the boundary layer on the external flow are simulated by a fictive body, its shape being calculated in analogy to the method of Grashof (1973). For the air foil section Goe801 pressure distributions were calculated and compared with experimental data. Author (ESA)

N77-25106# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.

NUMERICAL INTEGRATION OF THE GOVERNING EQUATIONS FOR THE DOMAIN OF PURE SUPERSONIC FLOWS

Claus Weiland 7 Dec. 1976 46 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-380)

(DLR-FB-76-65) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, DM 19,60

Three-dimensional steady inviscid flow fields arising at pointed or blunted bodies at supersonic freestream Mach numbers were calculated. The gasdynamic equations of motion were integrated by means of a finite difference procedure. Since this procedure is also to be applied to relative low supersonic freestream Mach numbers and angles of attack between 0 and 30 deg the system of equations is retained hyperbolic in marching direction by a special coordinate transformation. Shock waves embedded in the flow field can be calculated by introduction of artificial dissipative terms although the governing equations are discretized in the nonconservative form. Results of sample calculations are in good agreement with experimental data for angles of attack less than 10 deg. Author (ESA)

N77-25107# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

BEHAVIOR OF A SUBSONIC FLOW PAST A THIN WING IN THE VICINITY OF THE LEADING EDGE

Jean-Sylvestre Darrozes Feb. 1977 40 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-401)

(ONERA-NT-1976-16; FR-ISSN-0078-3781) Avail: NTIS HC A03/MF A01

The technique of matched asymptotic expansions leads to a uniformly valid description of a subsonic flow past a thin wing with round edges. The outer solution is the classical one given by the linearized theory. The inner problem requires a local formulation which corresponds to a local subsonic flow past a parabola in a plane normal to the leading edge. The inner solution is given explicitly in the case of weakly subsonic flows.

Author (ESA)

N77-25108# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

A COMPARISON BETWEEN EXPERIMENT AND DIRECT-SIMULATION CALCULATIONS OF THE HYPERSONIC RAREFIED FLOW FIELD OVER A FLAT PLATE WITH AND WITHOUT A FORWARD FACING STEP

J. Davis and J. K. Harvey Jan. 1977 37 p refs

(IC-Aero-76-05) Avail: NTIS HC A03/MF A01

Rotational temperature and density profiles obtained using the electron beam fluorescence technique in the Imperial College hypersonic wind tunnel are compared with Monte-Carlo direct-simulation calculations. These incorporate a statistical collision model and an inverse power potential for two simple model configurations. Good qualitative agreement is demonstrated and possible improvements to experiment and simulations are suggested. Author (ESA)

N77-25109# Ballistic Research Labs., Aberdeen Proving Ground, Md.

EXPERIMENTAL MEASUREMENTS OF THE TURBULENT BOUNDARY LAYER ON A YAWED, SPINNING SLENDER BODY Final Report

Walter B. Sturek and James E. Danberg Jan. 1977 29 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A035269; BRL-1954) Avail: NTIS HC A03/MF A01 CSCL 20/4

Experimental measurements of the tripped turbulent boundary layer profile characteristics on a yawed, spinning tangent-ogive-cylinder model are described. The profile measurements were made using a flattened total head probe at 30 deg increments completely about the azimuthal plane for three longitudinal stameter by a factor of two from the wind to the lee-side. A small but consistent effect of spin is also apparent.

Author (GRA)

N77-25110# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

EXPERIMENTAL EVALUATION OF THE EFFECT OF ROTATION ON THE AERODYNAMIC CHARACTERISTICS OF TWO ROTOR HUB FAIRING SHAPES

Peter S. Montana Sep. 1976 71 p refs

(WF41421201)

(AD-A033555; DTNSRDC/ASED-364) Avail: NTIS

HC A04/MF A01 CSCL 20/4

An experiment was performed to demonstrate that the drag of rotor hub fairings for high speed helicopters is not a function of advance ratio. Two hub fairing shapes were evaluated both with and without simulated blade shanks over a range of hub advance ratios from 0.5 to infinity. It was determined that the drag coefficient, and most other coefficients, is constant for hub advance ratios greater than about 3.0. Author (GRA)

N77-25111# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

EXPERIMENTAL EVALUATION OF ANALYTICALLY SHAPED HELICOPTER ROTOR HUB-PYLON CONFIGURATIONS USING THE HUB PYLON EVALUATION RIG

Peter S. Montana Jul. 1976 104 p refs

(WF41421201)

(AD-A033554; DTNSRDC/ASED-355) Avail: NTIS HC A06/MF A01 CSCL 20/4

The hub-pylon evaluation rig, a new facility for wind tunnel experiments on large scale helicopter rotor hub-pylon configurations, was used to determine the variation of hub-pylon drag with shaft angle and height, and pylon angle parameters. In addition, a series of low drag area rule fairings and shaft fairings were evaluated. The results indicate that the proper selection of shaft angle with respect to the pylon and pylon angle of attack can yield a twenty percent reduction in drag for a given shaft angle of attack. An additional reduction in drag of at least twenty percent is achievable with a properly designed area rule fairing. Author (GRA)

N77-25112# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.

SPANWISE-PERIODIC THREE DIMENSIONAL DISTURBANCES IN NOMINALLY 2-D SEPARATING LAMINAR BOUNDARY LAYER FLOWS. PART 1: THEORETICAL FORMULATION Interim Report

M. Neamtu and G. R. Inger Aug. 1976 54 p refs

(Grant AF-AFOSR-2173-72; AF Proj. 9781)

(AD-A033307; VPI-AERO-052; AFOSR-76-1206TR) Avail: NTIS CSCL 20/4

The results of a preliminary investigation on the stability of a nominally-two-dimensional laminar boundary layer flow approaching the separation point with respect to 3-D periodic spanwise disturbances, under the hypothesis that a steady state is reached, are presented. The basic equations of the disturbances are examined with an assumed form of the 3-D perturbations, resulting in a system of ordinary differential equations. Together with the boundary conditions requiring the disturbances to be zero at the wall and to vanish asymptotically at infinity, a two-point eigenvalue problem was formulated. Meksyn's method was adapted for the calculation of the basic two-dimensional flow parameters entering the equations in the region near the separation point. This method requires that the experimentally determined streamwise variation of the pressure at the edge of the boundary layer be known a priori. Author (GRA)

N77-25113# Aeronautical Research Associates of Princeton, Inc., N. J.

STUDY OF THE FEASIBILITY OF CONDUCTING A WAKE-RIDING EXPERIMENT USING A T-2 AIRCRAFT BEHIND TWO P-3 AIRCRAFT Final Report, 19 Apr. - 17 Aug. 1976

Coleman DuP. Donaldson, Guy G. Williamson, Alan J. Bilanin, and Richard Snedeker Aug. 1976 90 p

(Contract N62269-76-C-0305)

(AD-A033101; ARAP-287) Avail: NTIS HC A05/MF A01 CSCL 20/4

A study has been made of a T-2 aircraft attempting to establish a wake-riding position behind two P-3 aircraft. The major objectives were to estimate structural loads in the wake rider and to evaluate wake entry and station keeping control techniques. The results of the study indicate that the root-bending load on the tail of the T-2 aircraft would be of the order of the design load if the aircraft were to inadvertently pass directly through the center of a trailing vortex from one of the P-3's. Thus the flight tests, as originally envisaged, must be considered as high risk experiments unless the tail of the T-2 were to be strengthened. If wake riding experiments are carried out, approach to the wake-riding position should be made from above using a reduced-power, constant-airspeed approach. In calm air the piloting task appears reasonable if the trailing vortices are marked by smoke or condensation. Author (GRA)

N77-25114# ARO, Inc., Arnold Air Force Station, Tenn.

CALCULATION OF THE LAMINAR VISCOUS SHOCK LAYER ON A BLUNT BICONIC BODY AT INCIDENCE TO SUPERSONIC AND HYPERSONIC FLOW Final Report, 1 Jul. 1975 - Jun. 1976

Arloe W. Mayne, Jr. AEDC Dec. 1976 34 p refs Sponsored by AF

(ARO Proj. V43A-07A; ARO Proj. V41C-80A)

(AD-A033225; ARO-VKF-TR-76-66; AEDC-TR-76-123) Avail: NTIS HC A03/MF A01 CSCL 20/4

A fully viscous shock layer computation method developed by others to treat laminar flow over a sharp cone at incidence to a supersonic or hypersonic free stream has been extended to consider the case of flow over a blunt biconic configuration at angle of attack. The basic method treats the flow between the body surface and the bow shock wave by one set of equations which are valid in both the viscous and inviscid flow regions. A description is given of the computational methods used, particularly the method developed to treat the viscous shock layer over the spherical nose and the method used to take data from the end of the forecone solution to provide initial data for starting the aft-cone solution. Results from calculations which have been performed using the method developed in this investigation are compared with results from boundary-layer and inviscid flow calculations and with experimental data. The present technique is validated by the good agreement between the computed data and experimental data. Author (GRA)

N77-25115# ARO, Inc., Arnold Air Force Station, Tenn.

MEASUREMENT AND MAPPING OF AERODYNAMIC HEATING IN VKF TUNNEL B WITH AN INFRARED CAMERA Final Report, 1 Jul. 1973 - 30 Jun. 1975

D. S. Bynum, F. K. Hube, C. M. Key, and P. M. Dyer AEDC Nov. 1976 36 p refs Sponsored by the Air Force

(AD-A033116; AEDC-TR-76-54; ARO-VKF-TR-75-152) Avail: NTIS HC A03/MF A01 CSCL 20/4

Heat-transfer data were obtained on a cone and a hemisphere-cylinder model using an infrared scanning camera. Data were obtained at Mach number 8 at free-stream Reynolds numbers ranging from 2,400,000 to 3,500,000 per foot and all tests were conducted at zero angle of attack. Runs with the cone were made with and without a boundary-layer trip to produce a variation in the heating distributions measured with the camera. Data compare favorably with theoretical heating levels and distributions. GRA

N77-25116# ARO, Inc., Arnold Air Force Station, Tenn.

AN INVESTIGATION OF THE HALF-MODEL REFLECTION-PLANE TECHNIQUE FOR DYNAMIC STABILITY TESTING AT TRANSONIC MACH NUMBERS Final Report, 16 Jan. 1973 - 31 Mar. 1976

T. O. Shadow AEDC Jan. 1977 94 p refs

(AD-A035567; ARO-PWT-TR-76-127; AEDC-TR-76-165) Avail: NTIS HC A05/MF A01 CSCL 20/4

An experimental investigation was made to determine the feasibility of the half-model reflection-plane technique for measuring dynamic stability derivatives in the transonic speed range. Three model configurations simulating an aircraft, a missile, and a bluff body were investigated both full and half span at Mach numbers from 0.6 to 1.2 and angles of attack from -2 to 90 deg. The half-model reflection-plane technique fully duplicated the full-span results only at subsonic subcritical speeds and angles of attack up to 20 deg. In tests at higher Mach numbers in the transonic range and higher angles of attack up to 90 deg, it was not demonstrated that the half-model technique can provide better than qualitative, order of magnitude results. GRA

N77-25117# Tel-Aviv Univ. (Israel). Dept. of Mathematical Sciences.

THE NUMERICAL COMPUTATIONS OF SUPERSONIC FLOW PAST BLUNT BODIES Final Report, 15 Apr. 1972 - 30 Jun. 1976

Saul S. Abarbanel 1977 52 p refs

(Grant AF-AFOSR-2370-72)

(AD-A035568; AFOSR-77-0044TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

Methods for computing numerically the flow past blunted bodies travelling at supersonic speed are developed, using finite difference schemes. The algorithms were constructed to deal with 2-D axisymmetric and 3-D configuration. Various configurations were investigated and the flow field around them computed. Comparison with available semi-empirical results for blunted cones at Mach number 3 shows good agreement. The 3-D algorithm was applied to an axisymmetric configuration and the results thus obtained show good agreement with the axisymmetric calculation. All the calculations are for the inviscid gas-dynamic case. Author (GRA)

N77-25118# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.

AIR-CUSHION-SUPPORTED VEHICLE FAN DYNAMIC RESPONSE: A REVIEW OF THE LITERATURE

David D. Moran Jun. 1976 98 p refs

(AD-A035907; SPD-695-01) Avail: NTIS HC A05/MF A01 CSCL 01/3

The mechanisms which constitute the dynamic response of air-cushion-supported vehicle lift fans subjected to unsteady excitation are summarized and examined through a review of research as reported in literature published between 1932 and 1976. GRA

N77-25119# ARO, Inc., Arnold Air Force Station, Tenn.

AN INVESTIGATION OF BOATTAIL GEOMETRY AND REYNOLDS NUMBER EFFECTS ON FOREBODY AND AFTERBODY DRAG AT TRANSONIC MACH NUMBERS Final Report

A. V. Spratley AEDC Feb. 1977 128 p refs Sponsored by the Air Force

(AD-A035872; ARO-PWT-TR-76; AEDC-TR-76-161) Avail: NTIS HC A07/MF A01 CSCL 01/3

An experimental investigation was conducted in the AEDC 16-foot Transonic Wind Tunnel (16T) to determine both Reynolds number and nozzle afterbody configuration effects on model forebody and afterbody drag. The model was a sting-mounted body of revolution with interchangeable contoured, cylindrical, and 15-deg boattail configurations. Pressure and force data were obtained at Mach numbers from 0.60 to 1.40 and unit Reynolds numbers from 1,470,000 per foot to 5,300,000 per foot. The experimental results showed that large variations in afterbody drag levels produced no significant change in forebody drag. The data also revealed that all three configurations exhibited little or no Reynolds number dependence subsonically and that only the 15-deg boattail afterbody was affected by Reynolds number supersonically. It was also demonstrated that data precision and wind tunnel calibration can have a significant effect on model drag and should be given careful consideration. Author (GRA)

N77-25120# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

VISCOUS SHOCK LAYER SOLUTIONS FOR HYPERSONIC SPHERE-CONES Final Report, Mar. - Oct. 1976

B. N. Srivastava, M. J. Werle, and R. T. Davis Jan. 1977 177 p refs

(Contract F40600-74-C-0011)

(AD-A035335; AEDC-TR-77-20) Avail: NTIS HC A09/MF A01 CSCL 20/4

An analysis and numerical solution of the fully viscous shock layer equations for hypersonic flow past spherically blunted cones is presented. Attention is drawn to the adverse effect in the numerical solution due to discontinuities in the flow derivatives caused by the discontinuity in the surface curvature at the sphere/cone tangency point, when the usual surface coordinate frame of reference is used. It is shown that a finite difference formulation that accounts for the imbedded gradient discontinuities resolves these numerical difficulties. This concept is demonstrated through a numerical scheme which utilizes a time dependent relaxation technique for the bow shock shape. A model problem analogous to the sphere/cone juncture problem is first formulated and finite difference schemes developed and demonstrated for this case. This approach is then extended to the solution of the viscous shock layer equations for hypersonic flow past spherically blunted cones with half cone angles varying from 30 deg to 0 deg at high Reynolds number. For these cases the present results are found to compare well with independent inviscid flow calculations. In addition, excellent comparisons with experimental pressure and heat transfer data on a 7.5 deg half angle cone are obtained. Author (GRA)

N77-25121# California Univ., Davis. Dept. of Mechanical Engineering.

METHODS FOR COMPUTING MAGNUS EFFECTS ON ARTILLERY PROJECTILES Final Report

Harry A. Dwyer Jan. 1977 17 p refs

(Contract DAHC04-72-A-0001; DA Proj. 1T1-61102-A-33H) (AD-A035330; BRL-CR-329) Avail: NTIS HC A02/MF A01 CSCL 19/1

This report describes the research effort which was undertaken to extend the capability of numerical techniques developed for computing Magnus effects over right circular cones to artillery projectile shapes of interest to the Army. The changes involved: (1) introduction of longitudinal pressure gradient effects in the boundary layer equations; (2) introduction of turbulent transport properties into the boundary layer equations; (3) modification of the inviscid flow computation for a more general body configuration; and (4) modification of the technique for computing the three dimensional displacement surface. Author (GRA)

N77-25122# Naval Postgraduate School, Monterey, Calif.

DEVELOPMENT OF A CONTROL VALVE TO INDUCE AN OSCILLATING BLOWING COEFFICIENT IN A CIRCULATION CONTROL ROTOR M.S. Thesis

James Lawrence Bauman Dec. 1976 52 p refs

(AD-A035909) Avail: NTIS HC A04/MF A01 CSCL 01/1

The circulation control rotor concept makes it possible to achieve large changes in lift coefficient, without changing angle of attack, by making only small changes in blowing coefficient. The concept has great potential in the area of rotary-wing aerodynamics, where implementation will require the generation of oscillating blowing coefficients. In order to examine the response of a circulation control airfoil to such an oscillating blowing coefficient, a simple control valve system was designed and built. The effectiveness of the control valve in oscillating the blowing coefficient at various frequencies and amplitudes was examined. An attempt to determine the effect of this oscillation on the instantaneous lift coefficient of the rotor was not successful. GRA

N77-25123# Naval Ship Research and Development Center, Bethesda, Md. Dept. of Central Instrumentation.

DESIGN OF A CIRCULATION CONTROL AIRFOIL MODEL FOR EVALUATION IN THE TRANSONIC WIND TUNNEL Technical Report, Jan. - Jun. 1976

Albert P. Clark Mar. 1977 38 p

(AD-A037204; CID-77-1) Avail: NTIS HC A03/MF A01 CSCL 01/3

A circulation control (CC) airfoil model able to withstand high aerodynamically induced loads and high internal pressure loads was designed, manufactured, and structurally evaluated. The CC airfoil, with a span approximately three times that of any CC model heretofore evaluated, successfully performed at air speeds up to Mach 0.8. Structural and design problems encountered, their resolution, and salient features of the design are discussed. GRA

N77-25124# Ballistic Research Labs., Aberdeen Proving Ground, Md.

SEPARATION AHEAD OF PROTUBERANCES IN SUPERSONIC TURBULENT BOUNDARY LAYERS Final Report

Raymond Sedney and Clarence W. Kitchens, Jr. Feb. 1977 36 p refs

(DA Proj. 1T1-61101-A-91A)

(AD-A037347; BRL-1958) Avail: NTIS HC A03/MF A01 CSCL 20/4

The data were obtained using the optical-surface indicator technique of visualizing the flow; its accuracy and reproducibility are discussed. The protuberances are immersed in the boundary layer on the wall of a supersonic wind tunnel. The relative importance of various non-dimensional groups is evaluated. The variation of primary separation distance is presented as a function

of obstacle dimensions, Mach number, and Reynolds number, the last being the least significant. These results do not support some scaling laws found in the literature. An alternative correlation is proposed which applies to both small and large cylindrical protuberances. Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N77-25125 Aeronautical Research Labs., Melbourne (Australia).
THE USE OF WRECKAGE TRAJECTORIES IN AIRCRAFT ACCIDENT INVESTIGATION
J. L. Kepert May 1976 18 p refs
(ARL/Struc-Note-427) Copyright. Avail: Issuing Activity

The characteristics of aircraft wreckage layouts obtained after an in-flight break-up are examined. The use of these data in accident investigation is discussed. Procedures are developed for the determination of some relevant parameters such as the position and altitude of breakup. Some of the problems which may be encountered are mentioned. The analysis of aircraft wreckage trajectories should be considered additional to, rather than a substitute for, more conventional accident investigation techniques. Author

N77-25126# National Aviation Facilities Experimental Center, Atlantic City, N. J.
FLIGHT TEST AND EVALUATION OF MDEC (MCDONNELL DOUGLAS ELECTRONICS CORPORATION) COLLISION AVOIDANCE SYSTEM Final Report, Jan. - Oct. 1975
Theodore J. Turnock, Henry Scozzafava, John J. Wojciech, and Kent T. Culbertson Feb. 1977 274 p refs
(AD-A037435/5; FAA-NA-76-23; FAA-RD-75-231) Avail: NTIS HC A12/MF A01 CSCL 01/2

The test and evaluation of commercial and general aviation versions of airborne collision avoidance system (ACAS) equipments which are candidates for selection in a National Standard Collision Avoidance System are covered. The CAU (collision avoidance unit) and Mini-CAS were evaluated for their communications range, reliability, synchronization, and their ability to provide timely and correct advisories and maneuver commands. In addition, range and range rate accuracy and display reliability were analyzed. It is concluded that the CAU and Mini-CAS equipments perform the collision avoidance function as described in ANTC 117. The operation of the ground and airborne equipment, along with brief descriptions of the aircraft installation, test instrumentation, flight test outline, and the various problems encountered during the evaluation are summarized. Author

N77-25127# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA, US GENERAL AVIATION, CALENDAR YEAR 1975 Aircraft Accident Data 1975 (summary)
25 Jan. 1977 200 p
(PB-264394/8; NTSB-ARG-77-1) Avail: NTIS HC A09/MF A01 CSCL 01B

Statistical information compiled from reports of 4,237 general aviation accidents that occurred during the calendar year 1975 is presented. Included in the total number of accidents are 51 collisions between aircraft. By coding each aircraft involved in the collisions, an additional 51 records were produced, which brought total accident records to 4,288. This figure reflects that actual number of pilots and aircraft involved in the accidents. GRA

N77-25128# CACI, Inc., Arlington, Va.
AN EVALUATION OF CARGO AIRCRAFT FOR ANTARCTIC FIELD PARTY SUPPORT OPERATIONS Final Report
Paul J. Williams Jul. 1976 51 p refs
(Contract N00019-76-C-0034)
(AD-A036008; CACI-R-7603) Avail: NTIS HC A04/MF A01 CSCL 01/3

The Division of Polar Programs of the National Science Foundation needs a small aircraft to support field party operations. A world-wide survey narrowed the field to five candidate aircraft, De Havilland Twin Otter, Short Skyvan and SD3-30, IAI Arava, and CASA Aviocar. No aircraft met all mandatory and all desirable requirements, but the with Otter met all mandatories and was the only aircraft with proven ski landing configuration. It was recommended for procurement. Author (GRA)

N77-25129# CACI, Inc., Arlington, Va.
STATISTICAL ANALYSES APPLIED TO THE US NAVY AIRCREW AUTOMATED ESCAPE SYSTEMS
Henry L. Crowson 30 Nov. 1976 96 p
(Contract N00019-76-C-0034)
(AD-A035067; NAVWESA-R-7606) Avail: NTIS HC A05/MF A01 CSCL 06/7

Statistical analyses methodologies, such as analysis of variance, non-parametric tests and hypothesis tests were applied to uncover trends and dependencies of ejection-related injuries. Ejection-related fatality patterns for the A-6 aircraft were developed deterministically. The A-4, A-5, A-6, A-7, F-4, F-8 and F-9 ejection-related injuries were investigated, and parent probability density functions derived. The A-4, A-6, A-7, F-4 and F-8 contain an underlying injury trend. Fatalities occur randomly upon ejection from the A-4, A-7, F-4 and F-8 aircraft. Fatalities do not occur randomly from the A-6 aircraft. Differences were revealed among various ejection fatality scenarios: hardware hazards, aircrew judgment, environmental conditions, aircraft associated with ejections, and ejection seats used in ejection. Author (GRA)

N77-25130# CACI, Inc., Arlington, Va.
STATISTICAL ANALYSIS METHODOLOGY FOR THE US NAVY AIRCREW AUTOMATED ESCAPE SYSTEMS Final Report
Henry L. Crowson 15 May 1976 129 p refs
(Contract N00019-76-C-0034)
(AD-A035068; NAVWESA-R-7605) Avail: NTIS HC A07/MF A01 CSCL 06/7

A statistical analysis methodology is proposed for the study of Aircrew Automated Escape Systems. A detailed explanation is given for the following: (1) data analysis; (2) applicable discrete probability density functions to include the binomial, Poisson, and multinominal; (3) Bayesian statistical theory and applications; (4) higher order contingency table data analysis; and (5) non-parametric (distribution free) statistical tests, to include the run test, and trend test, and Fisher's Exact Test. Continuous probability density functions discussed include the normal, gamma and beta density functions. A brief exposition of small sample statistical analysis, to include sampling probability density functions, is also given. The sampling probability density functions considered are the Chi-Square, T, and F. Author (GRA)

N77-25131# BioTechnology, Inc., Falls Church, Va.
A SUMMARY OF NAVY AIR COMBAT ESCAPE AND SURVIVAL Final Report
Martin G. Every Feb. 1977 64 p refs
(Contract N00014-72-C-0101; NR Proj. 105-667)
(AD-A035913) Avail: NTIS HC A04/MF A01 CSCL 01/3

Previous reports issued during this study have included the examination of biomedical issues relating to combat escapes from aircraft, for Navy aircrewmen who were recovered or became prisoners of war during the Southeast Asia conflict. The data collected and analyzed from these groups proved highly beneficial in establishing injury cause and effect relationships. It was recognized however, that it did represent only that group which was successful in surviving the mishap. To completely evaluate the effectiveness of aircraft escape and survival equipment, statistics on those who were not successful would have to be included. Consequently, this phase of the study was devoted to the collection and analyses of Navy pilots who, during combat, ejected and are classified as missing or killed in action. The escape and survival data from all these casualty groups were combined into a computerized data base representing the total combat picture. From this data base, specific biomedical escape analyses were conducted and are presented in this report. GRA

N77-25132# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
AERONAUTICAL SYSTEMS TECHNOLOGY NEEDS: ESCAPE, RESCUE, AND SURVIVAL Annual Report, Jan. - Dec. 1977
Donald C. Kittinger Jan. 1977 22 p Supersedes ASD-TR-77-2
(AD-A035251; ASD-TR-77-2) Avail: NTIS HC A02/MF A01 CSCL 06/7

This report is a part of a compilation of formalized Technology Needs (TN) covering Equipment Subsystems as identified by the Aeronautical Systems Division. They are based on development/operational experience, systems studies and new concepts - all related to future system applications. Their presentation is to serve a threefold purpose; i.e., (1) guidance for technology program, (2) proven developmental potential, and (3) engineering data/requirements essential for technology use in systems. The identified needs delineate progress desired in performance, control, design flexibility, safety, and cost. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N77-25133*# Airborne Instruments Lab., Farmingdale, N.Y.
MICROWAVE SCANNING BEAM LANDING SYSTEM COMPATIBILITY AND PERFORMANCE: ENGINEERING ANALYSES 75-1 AND 75-2 Final Report
Apr. 1977 478 p refs
(Contract NAS9-14543)
(NASA-CR-151428) Avail: NTIS HC A21/MF A01 CSCL 17G

The microwave scanning beam landing system (MSBLS) is the primary position sensor of the Orbiter's navigation subsystem during the autoland phase of the flight. Portions of the system are discussed with special emphasis placed on potential problem areas as referenced to the Orbiter's mission. Topics discussed include system compatability, system accuracy, and expected RF signal levels. A block and flow diagram of MSBLS system operation is included with a list of special tests required to determine system performance. Author

N77-25134# Noah (J. Watson) Associates, Inc., Falls Church, Va.
COST BENEFIT ANALYSIS AND THE NATIONAL AVIATION SYSTEM: A GUIDE Final Report
J. Watson Noah, R. A. Groemping, J. E. Berterman, and O. L. Greynolds Feb. 1977 230 p refs
(Contract DOT-FA76WA-3769)
(AD-A037434/8; FR-1191-FAA; FAA-AVP-77-15) Avail: NTIS HC A11/MF A01 CSCL 01/2

A method is described for determining cost benefits of the national aviation system. Selected values for potential use in Federal Aviation Administration studies are discussed along with the principles, concepts, and techniques appropriate to estimating benefits and life cycle costs. In addition, parameters useful for valuing changes in capacity, delay, and aviation safety are presented. Author

N77-25135# Institute for Telecommunication Sciences, Boulder, Colo.
THE MEASUREMENT OF MICROWAVE MULTIPATH IN AN AIRPORT ENVIRONMENT Final Report
R. W. Hubbard, L. E. Pratt, and W. J. Hartman Jan. 1977 74 p refs
(Contract DOT-FA74WAI-471)
(AD-A037791/1; FAA-RD-76-163) Avail: NTIS HC A04/MF A01 CSCL 17/7

Multipath in an operating airport, and its impact on the performance of a microwave landing system (MLS) is an important aspect of the development of these systems. Test programs on the candidate MLS systems developed in the U.S. were conducted in areas that do not emulate large commercial airports. In order to better evaluate multipath in a realistic environment, measurements of reflected signals at the MLS operating frequency were performed, and the results used to develop or modify a computer simulation program. Both a cw system and a pseudorandom noise channel probe were used in the measurement program. The results of multipath measurements made on: (1) airport terminal buildings, (2) large maintenance hangars, and (3) aircraft on the surface of the airport are presented. Significant reflection levels are prevalent from these sources, and can produce a multipath reception problem at the receiver of an aircraft approaching the runway. Author

N77-25136# National Aerospace Lab., Amsterdam (Netherlands). Flight Dynamics Div.
EXPLORATORY INVESTIGATION OF DECELERATING APPROACHES OF A TWIN-ENGINED JET TRANSPORT. VOLUME 1: FIXED-BASE SIMULATION
C. F. G. M. Hofman 26 Mar. 1976 86 p refs
(Contracts NIVR-1747; RB-RLD-74-1.1)
(NLR-TR-75171-U) Avail: NTIS HC A05/MF A01

An exploratory investigation on a fixed-base flight simulator was conducted in order to obtain pilots' opinions on decelerating approaches and to determine what would be required to enable pilots to fly these approaches. A twin-engine jet transport aircraft of the Douglas DC-9-10 type was used. The symmetric equations of motion were programmed on an analog computer. Five approach procedures were investigated and four airline pilots contributed to the execution of the flight tests. All approaches were simulated in moderate to severe atmospheric turbulence. Pilots were asked to give their opinion on the acceptability of the various procedures. Statistical tests for measured performance variables and ratings to compare the various procedures were performed. It was concluded that a simulation investigation with a moving base flight simulator and a more complete simulated aircraft is recommended in order to present the pilots with more realistic circumstances. ESA

N77-25137# Plessey Co. Ltd., Addlestone (England). Engineering Dept.
STUDY OF THE INTEGRATION AND EVALUATION OF AN AERONAUTICAL SATELLITE SYSTEM IN OCEANIC AIR TRAFFIC CONTROL CENTRE Final Report
J. Neal, E. J. Bishop, A. Flint, W. Sewell, and I. Griffith 23 Nov. 1971 118 p refs 2 Vol.
(Contract ESTEC-1346/71-GC)
(Rept-84/71/37-Vol-1) Avail: NTIS HC A06/MF A01

An analysis is presented of a system using aeronautical satellites as a means of providing an air traffic control facility in the North Atlantic (Aerosat system). The main concern is achievement of a reduction of separation standards. Criteria for systems evaluation, and for systems performance judgement, were developed. The information flow between pictorial and tabular displays and computer elements is discussed. The effects of several parameters on systems models are described. Functions of a central computer are studied. Effects of signal loss are considered. ESA

N77-25138# Plessey Co. Ltd., Addlestone (England). Engineering Dept.
STUDY OF THE INTEGRATION AND EVALUATION OF AN AERONAUTICAL SATELLITE SYSTEM IN OCEANIC AIR TRAFFIC CONTROL CENTRE Final Report
J. Neal, E. J. Bishop, A. Flint, W. Sewell, and I. Griffith 23 Nov. 1971 102 p 2 Vol.
(Contract ESTEC-1346/71-GC)
(Rept-84/71/42-Vol-2) Avail: NTIS HC A06/MF A01

An analysis is presented of a system using aeronautical satellites as a means of providing an air traffic control (ATC) facility in the North Atlantic (Aerosat system). The alarm thresholds required to enable an ATC function to be carried out are analyzed. A method of allocating flights to lanes and time slots, as well as showing how flight paths can be merged and crossed, is defined. A likely flow of information along the surveillance and communication channels and across subsystem interfaces is

analyzed. System operation under certain failure conditions is outlined. ESA

N77-25139# Societe d'Etudes des Systemes d'Automation, Paris (France).

STUDY OF THE INTEGRATION AND EVALUATION OF AIR TRAFFIC CONTROL SYSTEMS IN AN AERONAUTICAL SATELLITE SYSTEM, VOLUME 1 Final Report [ETUDE THEORIQUE DE L'INTEGRATION ET DE L'EVALUATION DES SYSTEMES DE CONTROLE DE LA CIRCULATION AERIENNE DANS LE CADRE D'UN SYSTEME DE SATELLITES AERONAUTIQUES, TOME 1]

18 Nov. 1971 155 p In FRENCH 2 Vol.
(Contract ESTEC-1377/71-CG)
(SESA-Ex-5030/14639/71-Vol-1) Avail: NTIS HC A08/MF A01

An analysis of a system using aeronautical satellites as a means of providing an air traffic control facility in the North Atlantic (Aerosat system) is presented. The present air traffic situation is described and its future growth discussed. A system is proposed consisting of a ground station network and two aeronautical satellites. The flight path structure and oceanic control intervention modes are discussed. Tasks of the oceanic control center, related messages, and communication channels are detailed. ESA

N77-25140# Societe d'Etudes des Systemes d'Automation, Paris (France).

STUDY OF THE INTEGRATION AND EVALUATION OF AIR TRAFFIC CONTROL SYSTEMS IN AN AERONAUTICAL SATELLITE SYSTEM, VOLUME 2 Final Report [ETUDE THEORIQUE DE L'INTEGRATION ET DE L'EVALUATION DES SYSTEMES DE CONTROLE DE LA CIRCULATION AERIENNE DANS LE CADRE D'UN SYSTEME DE SATELLITES AERONAUTIQUES, TOME 2]

18 Nov. 1971 123 p refs In FRENCH 2 Vol.
(Contract ESTEC-1377/71-CG)
(SESA-Ex-5030/14639/71-Vol-2) Avail: NTIS HC A06/MF A01

An analysis of a system using aeronautical satellites as a means of providing an air traffic control facility in the North Atlantic (Aerosat system) is presented. Hardware and Software configurations for the ground, space, and mobile system segment are considered. The effect of failures is analyzed. Problems occurring in case of systems extension are surveyed. A theoretical study on the reduction of separation standards is reported. ESA

N77-25141# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services and Special Projects Div.

A SLOTTED WAVEGUIDE ANTENNA AS A MARKER BEACON FOR AIRCRAFT

O. B. M. Pietersen and F. Klinker 1 Jul. 1975 15 p refs Presented at the IEEE/AP-S Intern. Symp., Urbana/Champaign, Ill., 2-5 Jun. 1975 Revised
(NLR-MP-75027-U-Rev) Avail: NTIS HC A02/MF A01

A position marker system used in aircraft certification flights is described. The system consists of a ground-based part, viz. a microwave transmitter and a fan-beam antenna, and an airborne part composed of receiving antenna, a crystal-video receiver, and a processor which interfaces the system to the usual recording equipment. Most attention is given to the design of the fan-beam antenna since the performance of the system depends heavily on it. Some measurement results of the antenna are given. For heights less than 1,000 m, the aircraft position can be determined (in one dimension) with the accuracy of a few meters. It is concluded that the signal in space generated by a slotted waveguide antenna, which is fed in the center and used in the difference mode, is suitable as a position marker signal for aircraft. Author (ESA)

N77-25142# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

STUDY OF A DRAG-FREE SATELLITE: PRESENTATION OF THE PROJECT AND SATELLITE PILOTING

Marcel Bismut, Jacques Beaussier, Alain Bernard, Jean-Louis Boulay, and Michel Gay Jan. 1977 47 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-382)
(ONERA-NT-1976-10) Avail: NTIS HC A03/MF A01

The NAUTEX project is intended as an experimental phase aimed at demonstrating the feasibility of a national navigation system, the NAUTE system (NAvigation by Use of Established Trajectories), based on a drag-free satellite. After a general presentation of the project, the work done at ONERA in cooperation with CNES (the French Space Agency) is described with a view to defining a first draft of the drag-free satellite piloting system. The main characteristics of a position detector derived from the CACTUS accelerometer are optimized from the results of internal perturbation evaluations, account being taken of the characteristics of the motors ensuring the piloting. The piloting law is studied for the operational phase, with drag compensation, and for that during which the proof mass of the position detector is acquired. Author (ESA)

N77-25143# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

STUDY OF A DRAG-FREE SATELLITE: ITS USE FOR NAVIGATION

Jean Besson, Elie Haziza, Claude Jamy, and Pierre Weber Jan. 1977 29 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-383)
(ONERA-NT-1976-12) Avail: NTIS HC A03/MF A01

The work carried out by ONERA, in cooperation with CNES (the French Space Agency), to ascertain the advantages to be expected from the use of a drag-free satellite in a navigation system is presented. These advantages are analyzed through studying the localization precision and the alleviation of processing by the user. A numerical simulation, performed on several realistic configurations of the system, permitted the determination of the various causes of error. It leads to the conclusion that the user's localization precision is related mainly to that of the satellite orbit control. The alleviation of the measurement processing by the user, brought about by the a priori knowledge of the satellite ephemerides, justified a feasibility study of a low-coat system adapted to the general navigation, for which the localization precision would be of the order of one nautical mile.
Author (ESA)

N77-25144# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

CONFLICT DETECTION AND RESOLUTION IN THE NETHERLANDS ATC-SYSTEM SARP II

J. M. TenHave and C. G. H. Scholten 15 Jun. 1976 12 p refs Presented at the 10th ICAS Congr., Ottawa, 3-9 Oct. 1976
(NLR-MP-76016-U) HC A02/MF A01

Two conflict detection methods which have been developed for overflying aircraft in the Netherlands airspace, and are based on long-term trajectory predictions, are described. The aim is that the conflict detection programs produce few false alarms and consume very little on-line processing time. This is met by the so-called block method, which is described. Investigations are also discussed with respect to a more complicated method, known as the critical-distance method, which will reduce the false alarm rate to its minimum value, set by the uncertainties in the trajectory predictions in the STC-computer system and by the lateral deviations from track of the aircraft. Author (ESA)

N77-25145# Naval Weapons Engineering Support Activity, Washington, D. C.

A COMPARISON BETWEEN THE AN/ARN-84 (V) AND THE AN/ARN-118 (V) TACANS, BASED ON THE LIFE CYCLE COST Final Report

Lawrence A. Cundari Nov. 1976 44 p
(AD-A035066; NAVWESA-R-7604) Avail: NTIS HC A03/MF A01 CSCL 17/7

TACAN (Tactical Air Navigation) equipments are being procured for the Navy, Coast Guard, and Air Force. The life-cycle costs and performance characteristics of different models of these equipments vary greatly. The two equipments currently being procured are the AN/ARN-84(V), for the Navy and Coast Guard, and the AN/ARN-118(V) for the Air Force. This report is a cost analysis based on the life cycles of these two equipments. It provides data intended to aid NAVAIR and OPNAV in making future procurements cost effective and responsive to both peacetime and war time TACAN requirements. Author (GRA)

N77-25146# Honeywell, Inc., St. Petersburg, Fla. Aerospace Div.
STANDARD PRECISION NAVIGATOR/GEANS MODIFICATION FOR EAR MOTION COMPENSATION Final Technical Report, Jun. 1974 - Jan. 1976
Daniel Gionet, Paul E. Hall, and Steven Samsel Nov. 1976 389 p
(Contract F33615-74-C-1068)
(AD-A035033; HONEYWELL-176-1; AFAL-TR-76-71) Avail: NTIS HC A17/MF A01 CSCL 17/7

STANDARD PRECISION NAVIGATOR/GEANS MODIFICATIONS FOR EAR MOTION COMPENSATION summarizes the technical accomplishments of the Modification Study Program for the period from the Preliminary Design Review 20-21 June 1974 through 1 January 1976. The study program included the design, brassboard fabrication, and functional testing of proposed modifications to the SPN/GEANS to meet the Electronically Agile Radar (EAR) motion compensation requirements. The design, analysis, and testing show these modifications to be feasible and readily adaptable to the SPN/GEANS. The modification to enable a SPN/GEANS to perform the EAR motion compensation requires the following hardware and software modifications: Hardware Modifications -- 1. Change the IMU isolator transmissibility to provide improved low frequency acceleration measurement capability. This will require raising the present 16 Hz isolator frequency to 40 Hz. 2. Adapt the SPN/GEANS gyro to withstand 20 g's shock. 3. Redesign the VMU Pulse Rebalance Electronics (PRE) circuitry to provide 0.00125 ft/sec/pulse delta V resolution (present resolution is 0.04 ft/sec/pulse). Two PRE boards, No. 1B and No. 2, are involved. 4. Redesign the IMU logic to accept high resolution delta V data, and provide high data rate (256 Hz) delta V and gimbal angle data transmission to the EAR Radar Data Processor. This will require design changes to one existing logic circuit board and the addition of one new board, which will increase the depth of the overall logic package. 5. Develop special test equipment to functionally check the 256 Hz data bus. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-25147*# Boeing Commercial Airplane Co., Seattle, Wash.
STUDY OF STHUCTURAL DESIGN CONCEPTS FOR AN ARROW WING SUPERSONIC TRANSPORT CONFIGURATION, VOLUME 1. TASKS 1 AND 2 Final Report
Aug. 1976 212 p refs
(Contract NAS1-12287)
(NASA-CR-132576-Vol-1; D6-42438-Vol-1) Avail: NTIS HC A10/MF A01 CSCL 01C

A structural design study was made, based on a 1975 level of technology, to assess the relative merits of structural concepts and materials for an advanced supersonic transport cruising at Mach 2.7. Preliminary studies were made to insure compliance of the configuration with general design criteria, to integrate the propulsion system with the airframe, to select structural concepts and materials, and to define an efficient structural arrangement. An advanced computerized structural design system was used, in conjunction with a relatively large, complex finite element model, for detailed analysis and sizing of structural members to satisfy strength and flutter criteria. A baseline aircraft design was developed for assessment of current technology and for use in future studies of aerostructural trades, and application of advanced technology. Criteria, analysis methods, and results are presented. Author

N77-25148*# Boeing Commercial Airplane Co., Seattle, Wash.
STUDY OF STRUCTURAL DESIGN CONCEPTS FOR AN ARROW WING SUPERSONIC TRANSPORT CONFIGURATION, VOLUME 2. TASKS 1 AND 2 Final Report
Aug. 1976 667 p refs
(Contract NAS1-12287)
(NASA-CR-132576-Vol-2; D6-42438-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 01C
For abstract, see N77-25147.

N77-25149*# Virginia Univ., Charlottesville.
DEVELOPMENT OF A DIGITAL AUTOMATIC CONTROL LAW FOR STEEP GLIDESLOPE CAPTURE AND FLARE Final Report
Nesim Halyo Washington NASA Jun. 1977 69 p refs
(Grant NAS1-12754)
(NASA-CR-2834) Avail: NTIS HC A04/MF A01 CSCL 01C

A longitudinal digital guidance and control law for steep glideslopes using MLS (Microwave Landing System) data is developed for CTOL aircraft using modern estimation and control techniques. The control law covers the final approach phases of glideslope capture, glideslope tracking, and flare to touchdown for automatic landings under adverse weather conditions. The control law uses a constant gain Kalman filter to process MLS and body-mounted accelerometer data to form estimates of flight path errors and wind velocities including wind shear. The flight path error estimates and wind estimates are used for feedback in generating control surface commands. Results of a digital simulation of the aircraft dynamics and the guidance and control law are presented for various wind conditions. Author

N77-25150*# Kanner (Leo) Associates, Redwood City, Calif.
GENERAL STUDY OF LIGHT PLANE SPIN, AFT FUSELAGE GEOMETRY, PART 1
L. Beaurain Washington NASA Jun. 1977 47 p Transl. into ENGLISH of French report, no. 77/03 from Institut de Fluides Mecanique de Lille, 28 Feb. 1977 p 1-28
(Contract NASw-2790)
(NASA-TT-F-17446) Avail: NTIS HC A03/MF A01 CSCL 01C

The effect of aft fuselage geometries on spin is studied in wind tunnel tests on a model. The geometric parameters studied are: shape of the fuselage frame, fuselage width, fuselage length and size of the vertical stabilizer. While the shape of the fuselage frame has a very strong effect on the type of spin, the effect of the width and length parameters is only moderate. The results of testing different vertical stabilizer sizes were surprising: reducing the size of the vertical stabilizer often had a beneficial effect on spin. Author

N77-25151*# Boeing Vertol Co., Philadelphia, Pa.
US ARMY HELICOPTER DESIGN DATCOM. VOLUME 1: AIRFOILS Final Report
L. U. Dadone 31 May 1976 295 p refs
(Contract NAS2-8637)
(NASA-CR-153247; AD-A033425; USAAMRDL-CR-76-2; D210-11097-1-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 20/4

This report contains airfoil data of interest for rotor applications. The data is presented in the form of lift, drag, and pitching moment coefficients and, in most cases, it covers the complete Mach number range from low subsonic to supercritical flow conditions. An introductory section presents airfoil data trends and information pertaining to the source and usefulness of such data. GRA

N77-25152# Aeronautical Research Labs., Melbourne (Australia).
THE PERFORMANCE OF AIRCRAFT CONTROL CABLES UNDER SERVICE CONDITIONS
M. B. Benoy, R. A. Fell, and P. H. Townshend Apr. 1977 38 p refs
(ARL/Struc-Note-424) Avail: NTIS HC A03/MF A01

Aircraft control cables broken or worn in service were examined. Mechanical tests and theoretical analysis, show the following factors contribute to failure: (1) abrasion of the cables on pulleys or fairleads causing a much more serious loss of strength than is apparent from surface wear; (2) brinelling of the individual wires in the strands due to fluctuating cable tension inducing high contact stresses between helically wound wires. This causes strain-hardening followed by brittleness in the hard-drawn wires leading to the formation of surface cracks; (3) fatigue of wires due to flexing around pulleys and fairleads; and (4) unobserved failure of the core strand due to the combined effects of (2) and (3). Published work on aircraft control cables

is reviewed. The development of standards and air-worthiness requirements is discussed. A bibliography, which includes wire ropes in general engineering, is included. Author

N77-25153# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
NON-LINEAR EFFECTS IN AIRCRAFT GROUND AND FLIGHT VIBRATION TESTS
G. Haidl 16 Sep. 1976 16 p refs Presented at the 43d AGARD Meeting on Struct. and Mater. Panel, London, 26 Sep. - 1 Oct. 1976
(MBB-UFE-1273-O) Avail: NTIS HC A02/MF A01

Examples of nonlinear vibration behavior in ground resonance tests of an aircraft are shown. Model tests for a simplified system with nonlinear properties were performed to study the effects of friction and backlash with respect to ground resonance test and flight flutter test. With symmetric and asymmetric nonlinear stiffness characteristics effects of amplitude dependent frequencies, mode coupling, mode asymmetries, and the consequences in parameter identification in vibration tests are pointed out and discussed. In case of flutter critical modes the problems of apparent damping caused by nonlinear system properties are shown, and recommendations are given to reach a representative flutter clearance with respect to this nonlinear system behavior. Author (ESA)

N77-25154# Messerschmidt-Boelkow G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge-Entwicklung.
WHAT IS THE RIGHT SIZE FOR RPVs?
Bernd Krogull Sep. 1976 10 p refs Presented at the Joint Symp. on Avionics, Guidance and Control for Remotely Piloted Vehicles at AGARD-Meeting, Florence, 4-8 Oct. 1976
(MBB-UFE-1272-O) Avail: NTIS HC A02/MF A01

Current remotely piloted vehicle (RPV) applications and proposals cover a large range of vehicle size from a few kilograms mass up to full aircraft size. This raises the question whether mini, midi, or maxi RPVs are required for particular military objectives. A broad spectrum of prospective tasks for unmanned vehicles was analyzed and effective and competitive RPV size classes for different missions were identified. It was concluded that there are four distinct unmanned aircraft classes: mini RPV, weighing less than 100 kp, for observation and harrassment tasks; midi RPVs in the 500 kp class utilized for air defence suppression and surveillance; somewhat heavier vehicles, in the 1 ton class, for combat tasks; and maxi RPVs, weighing more than 2 tons, for special missions. Author (ESA)

N77-25155# Lockheed-California Co., Burbank.
OTTAWA STRAY RIG TESTS OF AN ICE PROTECTION SYSTEM APPLIED TO THE UH-1H HELICOPTER Final Report, 20 Jan. - 30 May 1976
R. H. Cotton Nov. 1976 97 p refs
(Contract DAAJ02-76-C-0012; DA Proj. 1F2-63209-DB-38)
(AD-A034458; LR-27694; USAAMRDL-TR-76-32) Avail: NTIS HC A05/MF A01 CSCL 01/3

Simulated icing flight tests were conducted on an advanced ice protection system as applied to an Army UH-1H helicopter in the NRC spray rig at Ottawa, Canada. The system provides for electrothermal cyclic deicing of the main and tail rotor blades, electrically-heated windshield and stabilizer bar, and ice detectors. The aircraft had been tested previously in simulated icing conditions behind the CH-47 HISS. A total of 18.1 hours of testing were accomplished in 54 days at Ottawa. Test conditions ranged from 0 deg C to -20 C and liquid water contents equivalent to the recommended atmospheric icing criterion for continuous maximum. The deicing controller system demonstrated excellent functioning and reliability characteristics. In general, the deicing of the rotor blades was considered to be good. Test results were obtained to define recommended heater-on times for deicing as well as heater-off time between cycles. Limited tail rotor icing and deicing were evaluated. Natural icing flights were planned after system readiness was established but none were made due to the lack of proper weather conditions. It is recommended that further testing be accomplished under natural icing conditions to complete the evaluation. Prior to this additional testing, another set of heated main rotor blades or modifications to existing blades, incorporating minor design and manufacturing changes, should be procured to preclude reoccurrence of the heater element-to-erosion shield short problem and other deficiencies noted from the experience to date. Author (GRA)

N77-25156# Army Aviation Systems Test Activity, Edwards AFB, Calif.
OH-58A AUTOROTATIONAL EVALUATION
Joseph C. Watts and Vernon L. Diekmann 29 Feb. 1972 22 p refs
(AD-A035727; USAASTA-71-46) Avail: NTIS HC A02/MF A01 CSCL 01/3

Several recent instances of tail-boom buckling have occurred after an autorotational touchdown in the OH-58A helicopter. These occurrences prompted the U.S. Army Aviation System Command (AVSCOM) light observation helicopter (LOH) Project Manager to enter into a product improvement program (PIP) with Bell Helicopter Company (BHC) to define the problem and recommend a solution. This PIP task included computer studies, a shake test, and flight testing of a structurally instrumented OH-58A helicopter. The results of the PIP task, to date, indicate that the tail-boom buckling resulted from a resonant condition between the main rotor and the natural frequencies of the fore and aft pylon mode and the tail boom. This resonant frequency, 5 hertz, was likely to occur at high blade angles, 100-percent collective, and low rotor speed, 150 RPM and was associated with large main rotor flapping excursions. Three solutions were considered: (1) change the natural frequencies of the fore and aft pylon mode and/or tail boom, (2) damp the pylon movement, and (3) eliminate the excessive blade flapping. The BHC chose the third solution by electing to restrict the maximum collective control travel which would, in turn, eliminate excessive flapping at low rotor speeds. The BHC testing showed that there was no degradation of helicopter performance as the result of the installation of an 80-percent collective pitch restriction device. GRA

N77-25157# Naval Surface Weapons Center, White Oak, Md.
RESPONSE OF A-6 LANDING GEAR DOOR TO AIR SHOCK LOADING Final Technical Report, Oct. 1975 - Apr. 1976
Joseph G. Connor, Jr. 24 Oct. 1976 60 p refs
(AD-A035459; NSWC/WOL/TR-76-94) Avail: NTIS HC A04/MF A01 CSCL 01/3

Response of an A-6 Aft Main Landing Gear Door to static and transient pressure loads has been calculated with the NASTRAN finite element structural analysis computer code. On the basis of manufacturer's static tests these doors have been considered to be the structural items on the plane most sensitive to shock loading. Displacements calculated for static loading compare favorably with those measured on tests. However, examination of the stress distribution in the door panels indicates that the 2.5 psi shock limit established by the manufacturer is conservative. The linear elastic NASTRAN stress calculations indicate that at an altitude of 50,000 ft the door should be able to withstand a 3 psi free-field shock normally incident on its outside surface if the peak stress is not to exceed the yield strength. At sea level, the door should withstand a free-field shock of 4.3 psi, normally incident. Author (GRA)

N77-25158# Kaman Aerospace Corp., Bloomfield, Conn.
ELASTIC PITCH BEAM TAIL ROTOR Final Report, Aug. 1971 - Apr. 1976
Paul F. Maloney and John D. Porterfield Dec. 1976 217 p refs
(Contract DAAJ02-72-C-0006)
(AD-A035175; R-1399; USAAMRDL-TR-76-35) Avail: NTIS HC A10/MF A01 CSCL 01/3

The objectives of this program were to demonstrate the flight worthiness and to evaluate the reliability and maintainability of the Elastic Pitch Beam tail rotor designed for the UH-1H helicopter. This was accomplished by an engineering program which included design, analyses, static testing, fatigue testing, whirl Beam tail rotor on a UH-1H helicopter. Author (GRA)

N77-25159# Kaman Aerospace Corp., Bloomfield, Conn.
DESIGN OF SELECTED HELICOPTER COMPONENTS FOR EASE OF REPAIR Final Report, Apr. 1975 - May 1976
Thomas N. Cook, Frank E. Starses, and Charles J. Wirth Dec. 1976 167 p refs
(Contract DAAJ02-75-C-0029; DA Proj. 1F2-62209-AH-76)

(AD-A035152; R-1464; USAAMRDL-TR-76-34) Avail: NTIS HC A08/MF A01 CSCL 01/3

This report examines the design of major helicopter components and its effect on the man-hour cost of field repair. Recommendations are developed for improving the field repairability of these components on future helicopters through improved applications of current technology and new design concepts. The study was accomplished in two phases. In the first, field surveys were conducted to identify significantly occurring repair actions in the field and the important elements of each repair task. Comments on repair problems were solicited from Army mechanics. Nine generic types of components on six helicopter models were investigated. Solutions available through improved applications of current technology were identified, and recommended design study projects were submitted for Army approval. In Phase 2, design studies were conducted for five generic types of parts found to be most significant from the standpoint of the man-hours they consume in repair and/or the number of complaints they received from mechanics in the field. Twenty-five design concepts were investigated. Each was subjected to an engineering critique that considered the effects on such factors as cost, weight, stress and performance. GRA

N77-25160# Calspan Corp., Buffalo, N.Y.
NORMAL STRESS, TEMPERATURE, AND PERFORMANCE PROPERTIES OF MILITARY AIRCRAFT TIRES Final Report, 6 Feb. - 11 Aug. 1975
James R. Hampton (AFFDL) Oct. 1976 104 p ref
(Contract F33615-75-C-0106; AF Proj. 1369)
(AD-A036153; CALSPAN-ZM-5689-T; AFFDL-TR-76-95) Avail: NTIS HC A06/MF A01 CSCL 01/3

Measurements were made of the normal stress and temperature of the 20 x 4.4/12 PR Type VII military aircraft tire while rolled at various speeds. On one tire, normal stress was measured at five locations in the tread area at the carcass and tread interface. On the second tire, the contained air temperature, contained air pressure, and the carcass temperature at the carcass and tread interface were recorded. Author (GRA)

N77-25161# Rock Island Arsenal, Ill.
THE INVESTIGATION OF DYNAMIC GUN POINTING ERRORS FOR HELICOPTER MOUNTED AUTOMATIC CANNON SYSTEMS Final Report, Jul. 1975 - Jun. 1976
Thomas D. Hutchings and Adam R. Zak 2 Nov. 1976 143 p refs
(DA Proj. 1F2-62201-DH-96)
(AD-A035138; RIA-R-TR-76-042) Avail: NTIS HC A07/MF A01 CSCL 01/3

In a helicopter-weapon-system, the dynamic gun-pointing errors, caused by the application of weapon recoil forces, are the helicopter airframe vibrations and the relative turret servocontrol oscillations between the interconnected rigid body segments (i.e., motions of the azimuth and the elevation drive systems). A two-step analytical procedure has been developed to quantify these errors for different weapon systems and for different operating conditions. In this analysis, the airframe dynamics are first determined with a finite-element structural vibration model; the dynamics of the turret servocontrol system are then determined with a model of the gun and turret. The results of the two models are combined to obtain the dynamic motions of the gun about the initial aim-position. Finally, the statistical mean and the standard deviation errors in gun pointing are derived from the dynamic gun vibration patterns. GRA

N77-25162# Bell Helicopter Co., Fort Worth, Tex.
ROTOR BLADE FLAPPING CRITERIA INVESTIGATION Final Report, Apr. 1975 - Jul. 1976
Larry W. Dooley Dec. 1976 100 p refs
(Contract DAAJ02-75-C-0030; DA Proj. 1F2-62209-AH-76)
(AD-A034459; USAAMRDL-TR-76-33; Rept-699-099-021) Avail: NTIS HC A05/MF A01 CSCL 01/3

The objective of this study was to identify helicopter characteristics critical to main rotor flapping and to attempt to establish flapping design criteria. Three helicopter types and three rotor systems were simulated in steady flight at maneuvers using the hybrid version of C81, Rotor craft flight Simulation Program. Critical operational characteristics were: at center of gravity extremes, under low or negative g conditions, with large abrupt control inputs, and in conditions of significant retreating blade stall. Operation outside recommended flight envelopes can cause excessive flapping. Helicopter characteristics influencing flapping were: flapping restraint, fuselage stability characteristics, and helicopter loading conditions. A limit flapping criterion is defined the same as current design specifications and should apply for all operations within the recommended flight envelopes of the helicopter. An ultimate flapping criterion is proposed for operations outside the recommended flight envelopes and for failure conditions. The ultimate flapping criterion requires no failure of primary structure due to flapping stop contact, and no rotor blade contact with the fuselage for conditions where probability of occurrence is not extremely remote. Author (GRA)

N77-25163# Army Aviation Systems Command, St. Louis, Mo. Systems Analysis Office.
REMOTELY PILOTED VEHICLE (RPV) MISSION CAPABILITY CONCEPTS AS RELATED TO US ARMY OPERATION DOCTRINE Final Report
Richard A. Radtke 12 Nov. 1976 18 p
(AD-A035392; DRSAV-D-76-13; USAAVSCOM-TR-77-2) Avail: NTIS HC A02/MF A01 CSCL 01/3

A review of Field Manual FM 100-5 Operations, 1 July 1976, has been made to determine those basic concepts of Army Operational capabilities outlined in the coordinated U.S. Army Intelligence Center and School (USAICS) preliminary RPV Operational and Organizational (O and O) Concepts, June 1976. GRA

N77-25164# Army Aviation Systems Command, St. Louis, Mo.
ARMY AVIATION RDT AND E PLAN: EXECUTIVE SUMMARY 5th Edition
Oct. 1976 24 p refs
(AD-A035351) Avail: NTIS HC A02/MF A01 CSCL 01/3

The Plan presents a time-phase analysis and presentation of the scientific and technological programs required to support the development of advanced airmobile systems responsive to the future needs of the Army. This document sets forth plans and objectives for Army aviation research and development activities for the FY77-96 period, with particular emphasis on the period from the present to 1981. Current R and D efforts in Army air mobility are directed primarily toward the development of a family of vertical and short takeoff and landing aircraft to fulfill identified requirements in the land combat functions of mobility, intelligence, firepower, combat service support, and command, control, and communications. Author (GRA)

N77-25165# Rockwell International Corp., Columbus, Ohio. Aircraft Div.
ON-WATER MOTION RELATIONSHIPS STUDY Final Report, 17 Aug. 1976 - 15 Jan. 1977
James D. Aurand 15 Jan. 1977 100 p refs
(Contract N00600-76-C-1606)
(AD-A035344; NR76H-137) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report presents an on-water head seas motion analysis of three C/STOL and three V/STOL sea based aircraft configurations. Heave, pitch, acceleration, and slamming/wetness conditions are determined. Different forward speed conditions were studied. The effect of various configuration parameters (length, inertia, c.g. location, water plane area, etc.) on head seas motion parameters was established. Sea state conditions from one to seven were studied. Fundamental sea state relationships and their effect on sea basing of aircraft are presented. Recommendations for subsequent model tank testing are indicated. GRA

N77-25166# Army Aviation Systems Command, St. Louis, Mo.
ARMY AVIATION RDT AND E PLAN
Oct. 1976 347 p refs
(AD-A035334) Avail: NTIS HC A15/MF A01 CSCL 01/3

Contents: Airmobile Systems Introduction -- Army Aviation Systems Requirements, Threat, Land Combat Functions, Major Thrusts, and IOC Dates; Airmobile Systems -- Mobility, Intelligence, Firepower, Combat Service Support, and Command, Control and Communications; Technology Introduction -- Analysis of Aircraft Concepts, Technological Requirements, Analysis of R and D Tasks, Analysis of Required Resources, Laboratory Project Selection Process, and Responsiveness to Science and Technical

Objectives; Aerodynamics; Structures; Propulsion; Reliability Maintainability; Safety and Survivability; Mission Support; Aircraft Subsystems; Aircraft Weaponization; Human Factors, Remotely Piloted Vehicles; Aviation Electronics; Manufacturing Technology; Advanced Technology Demonstration; Tilt Rotor Air Vehicle, Rotor System Research Aircraft, Advancing and Blade Concept, and Advanced Structures Technology Demonstrator; Mathematical Science; Aircraft Systems Synthesis; Fundamental Sciences; and Resources Required. Author (GRA)

N77-25167# Army Aviation Systems Command, St. Louis, Mo. Systems Analysis Office.
THE EFFECT OF THE OPERATIONAL READINESS OF THE FLOAT ON THE OPERATIONAL READINESS OF THE ENTIRE FLEET Final Report
D. Frank Fox Jan. 1977 26 p refs
(AD-A035748; DRSAV-D-77-1; USAAVSCOM-TR-77-1) Avail: NTIS HC A03/MF A01 CSCL 01/3

In general, for a fleet of aircraft, the operational readiness of the float is much lower than that of the rest of the fleet. The inclusion of the float in the calculation of the operational readiness for the fleet causes the operational readiness to be lower than it would otherwise be. Formulas are derived which show the magnitude of the decrease in the operational readiness and the relationships between the operational readiness rates of the fleet and its float. GRA

N77-25168# Naval Ship Research and Development Center, Bethesda, Md.
THE OVERLAND VERTICAL PLANE DYNAMIC RESPONSE OF THE AALC JEFF(B) ACV MODEL EXPERIMENTS
David D. Moran Jun. 1976 67 p refs
(AD-A035846; SPD-615-04) Avail: NTIS HC A04/MF A01 CSCL 01/3

The overland dynamic behavior of an air-cushion-supported vehicle is investigated. Experiments have been performed by running the craft over repeated rigid wave forms and allowing it to pitch and heave. Transfer functions relating response variables to the excitation variables are presented. The linearity of the vertical plane dynamics is investigated through a comparison of the response for two different wave heights. Variations in fan speed and fan discharge are also examined. The cobblestone effect, created by exciting the craft at a very high frequency, is investigated. Author (GRA)

N77-25169# Bell Helicopter Co., Fort Worth, Tex.
AH-1G HELICOPTER AERODYNAMIC AND STRUCTURAL LOADS SURVEY Final Report, Jun. 1974 - Apr. 1976
Gerald A. Shockey, Joe W. Williamson, and Charles R. Cox Feb. 1977 365 p refs
(Contract DAAJ02-73-C-0105; DA Proj. 1F2-62209-AH-76)
(AD-A036910; Rept-699-099-017; USAAMRDL-TR-76-39)
Avail: NTIS HC A16/MF A01 CSCL 01/1

Accurate prediction of helicopter system loadings required detailed knowledge of rotor aerodynamic environments and structural dynamic responses. This report describes a flight test program of an AH-1G helicopter where airfoil surface pressure, leading edge stagnation point, local flow magnitude and direction, blade accelerations, bending moments, and the attendant responses in the control system and airframe were measured simultaneously. The hardware development, instrumentation techniques, test conditions, and initial data analyses are discussed. The development of a rotating frequency-division multiplex, capable of regulating and conditioning over 300 transducer signals, and the component testing and calibration of those transducers are described. Samples are presented of pressure distributions, leading edge stagnation point versus azimuth, and surface flow magnitude and direction. Aerodynamic forces and responses in the rotor and control systems are presented and compared with predicted analytical values. Acoustic signals and airload fluctuations are used to locate and define the origin of rotor noise during high-speed flight and in operating regimes of strong wake interaction. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-25170# Air Force Academy, Colo.
PRESSURE DRIVEN ANGLE OF ATTACK INDICATING SYSTEM Final Report, Mar. 1972 - Mar. 1975
Roger W. Gallington and James W. Christian Jan. 1976 101 p refs
(AF Proj. 7905; ILIR Proj. 74-11)
(AD-A035321; AFATL-TR-76-10) Avail: NTIS HC A06/MF A01 CSCL 01/4

Technically inclined flyers have long recognized the importance to the pilot of angle of attack information. Unfortunately, a reliable, accurate, and low cost angle of attack indicator has not been available. From the outset, the goal of this research has been to develop an angle of attack indicator as simple, accurate, reliable, and inexpensive as the common airspeed indicator so that it could be used as a primary landing approach aid and for the other flight control functions. This report describes the solution to that problem. GRA

N77-25071# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
TIME-DIVISION MULTIPLEXED DATA BUS INTEGRATION TECHNIQUES
Erwin C. Gangel *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 9 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-25171*# Boeing Co., Seattle, Wash.
A METHOD TO ESTIMATE WEIGHT AND DIMENSIONS OF AIRCRAFT GAS TURBINE ENGINES. VOLUME 1: METHOD OF ANALYSIS Final Report
R. J. Pera, E. Onat, G. W. Klees, and E. Tjonneland May 1977 50 p refs
(Contract NAS3-19913)
(NASA-CR-135170; D6-44258-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 21E

Weight and envelope dimensions of aircraft gas turbine engines are estimated within plus or minus 5% to 10% using a computer method based on correlations of component weight and design features of 29 data base engines. Rotating components are estimated by a preliminary design procedure where blade geometry, operating conditions, material properties, shaft speed, hub-tip ratio, etc., are the primary independent variables used. The development and justification of the method selected, the various methods of analysis, the use of the program, and a description of the input/output data are discussed. Author

N77-25172*# Boeing Co., Seattle, Wash.
A METHOD TO ESTIMATE WEIGHT AND DIMENSIONS OF AIRCRAFT GAS TURBINE ENGINES. VOLUME 2: USER'S MANUAL Final Report
R. J. Pera, E. Onat, G. W. Klees, and E. Tjonneland May 1977 42 p refs
(Contract NAS3-19913)
(NASA-CR-135171; D6-44258-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 21E

For abstract, see N77-25171.

N77-25173*# Boeing Co., Seattle, Wash.
A METHOD TO ESTIMATE WEIGHT AND DIMENSIONS OF AIRCRAFT GAS TURBINE ENGINES. VOLUME 3: PROGRAMMER'S MANUAL Final Report
R. J. Pera, E. Onat, N. L. Prewitt, G. W. Klees, and E. Tjonneland May 1977 167 p
(Contract NAS3-19913)
(NASA-CR-135172; D6-44258-Vol-3) Avail: NTIS HC A08/MF A01 CSCL 21E
For abstract, see N77-25171.

N77-25174*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL APPARATUS FOR INVESTIGATION OF FAN AEROELASTIC INSTABILITIES IN TURBOMACHINERY
William H. Jones, Walter A. Bishop, Thomas A. Kirchgessner, and John H. Dicus Washington Jun. 1977 32 p refs
(NASA-TM-X-3508; E-9088) Avail: NTIS HC A03/MF A01 CSCL 21E
The application, installation, and monitoring of dynamic strain gage instrumentation on the rotating fan blades for subsonic stalled flutter mode of the first fan rotor are described. The engine installation, the modifications to the engine controls to obtain off schedule operation of the fan, engine aerodynamic instrumentation, and general data acquisition systems are discussed. Author

N77-25175# Boeing Aerospace Co., Seattle, Wash.
INTEGRATED PROPULSION CONTROL SYSTEM (IPCS). VOLUME 1: SUMMARY Final Technical Report, 1 Mar. - 30 Aug. 1976
Leon O. Billig Aug. 1976 39 p
(Contract F33615-73-C-2035)
(AD-A032439; AFAPL-TR-76-61-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 21/5
The Integrated Propulsion Control System (IPCS) program was conducted to pursue and demonstrate the advantages of integrated propulsion controls. The program encompassed the design, build, flight qualification, and flight testing of control modes, software, and hardware. The flight test vehicle was an F-111E. The left inlet and TF30-P-9 engine were modified to operate under control of an HDC-601 computer. Two sets of hardware were built or modified and two sets of software were developed; one implemented the bill-of-materials control laws and one implemented control laws developed under contract. A step-by-step sequence of tests of increasing complexity demonstrated suitability for flight. Fifteen flights were conducted to evaluate the IPCS. The program description and results are summarized in this document. Author (GRA)

N77-25176# Boeing Aerospace Co., Seattle, Wash.
INTEGRATED PROPULSION CONTROL SYSTEM. VOLUME 4: METHODOLOGY Final Technical Report, 1 Mar. 1973 - 30 Aug. 1976
Leon O. Billig Aug. 1976 114 p refs
(Contract F33615-73-C-2035)
(AD-A033062; AFAPL-TR-76-61-Vol-4) Avail: NTIS HC A06/MF A01 CSCL 21/5
The IPCS program proved that the operational capability of aircraft can be expanded by use of integrated propulsion controls. The techniques employed to achieve this improved performance include (1) early planning for integration, (2) early involvement of all concerned parties, and (3) freer communication, down to the working engineer level, than is considered common. Proper use and management of these three items constitutes the IPCS methodology. The goal of the methodology document is to provide assistance in establishing the philosophy and direction that will minimize program risk and cost. Author (GRA)

N77-25177# Lockheed-Georgia Co., Marietta.
THE GENERATION AND RADIATION OF SUPERSONIC JET NOISE. VOLUME 2: STUDIES OF JET NOISE, TURBULENCE STRUCTURE AND LASER VELOCIMETRY Final Technical Report, 6 Nov. 1972 - 6 Nov. 1976
Harry E. Plumblee, Jr., ed., Robert H. Burrin, Jark C. Lau, Christopher L. Morfey, Philip J. Morris, David M. Smith, H. K. Tanna, Bria J. Tester, and M. Clay Whiffen 23 Jun. 1976 460 p refs Sponsored in part by DOT
(Contract F33615-73-C-2032; AF Proj. 3066)
(AD-A032881; LG76ER0133-Vol-2; AFAPL-TR-76-65-Vol-2)
Avail: NTIS HC A20/MF A01 CSCL 20/1
This volume discusses: (1) turbulent mixing noise tests and observations relative to effects of temperature and Mach number on intensity, directivity, and spectra; (2) numerical solutions of the Lilley theory for sound radiated from point sources simulating small-scale turbulence noise sources, and comparisons of these solutions with experimental data relating to temperature and velocity effects on directivity and spectra; (3) the theory describing the development of the large-scale coherent motion of the jet structure and the far-field noise radiated from this turbulence; (4) a detailed discussion and interpretation of the jet turbulence and mean velocity data; and (5) a comprehensive description of the shock-associated noise tests, a preliminary description of the broadband shock-associated noise model, and a discussion of shock-associated noise in the overall jet noise picture. GRA

N77-25178# Lockheed-Georgia Co., Marietta.
THE GENERATION AND RADIATION OF SUPERSONIC JET NOISE. VOLUME 3: TURBULENT MIXING NOISE DATA Final Technical Report, 6 Nov. 1972 - 6 Nov. 1975
H. K. Tanna, Peter D. Dean, and Robert H. Burrin 23 Jun. 1976 472 p Sponsored in part by DOT
(Contract F33615-73-C-2032; AF Proj. 3066)
(AD-A032882; LG76ER0133-Vol-3; AFAPL-TR-76-65-Vol-3)
Avail: NTIS HC A20/MF A01 CSCL 20/1
The characteristics, both spectral and directivity, of the sound field of supersonic shock-free jets are studied by measuring the turbulent mixing noise in the far field from four two-inch diameter nozzles, namely a convergent nozzle for pressure ratios up to critical and three convergent-divergent nozzles having nominal design Mach numbers of 1.4, 1.7, and 2.0, respectively. The measurements were conducted in a free-field environment. The results from 75 jet exit conditions are presented in a systematic manner in the form of tabulated one-third octave spectra. The test program was carefully planned in order to obtain results (1) at constant jet efflux temperature with varying jet velocity, and conversely (2) at constant exit velocity while varying jet efflux temperature. The effects of jet velocity and exhaust temperature on turbulent mixing noise can therefore be assessed independently. GRA

N77-25179# Lockheed-Georgia Co., Marietta.
THE GENERATION AND RADIATION OF SUPERSONIC JET NOISE. VOLUME 4: SHOCK-ASSOCIATED NOISE DATA Final Technical Report, 6 Nov. 1972 - 6 Nov. 1975
H. K. Tanna, Peter D. Dean, and Robert H. Burrin 23 Jun. 1976 416 p Sponsored in part by DOT
(Contract F33615-73-C-2032; AF Proj. 3066)
(AD-A032883; LG76ER0133-Vol-4; AFAPL-TR-76-65-Vol-4)
Avail: NTIS HC A18/MF A01 CSCL 20/1
The characteristics of the sound field of shock-containing under-expanded jets are studied by measuring the noise from a two-inch diameter convergent nozzle over an extensive envelope of supercritical jet operating conditions. The measurements, which are accurate and comprehensive, were conducted in the Lockheed anechoic facility. The results are presented in this volume in a systematic manner in the form of narrowband spectra. The details pertinent to the experimental program and the data presentation format are summarized below. The total noise spectrum from an incorrectly expanded jet flow contains discrete components (or screech) in addition to the basic turbulent mixing noise and the broadband shock-associated noise. In order to study the trends and dependencies of the broadband component accurately, it is vital to keep the contamination by screech to a minimum in the experimental program. In the present experiments, screech suppression was successfully achieved by wrapping all surfaces surrounding the nozzle exit with sound absorbing material, and incorporating a small projection inside the nozzle lip. This projection interrupts the feedback loop between the first shock and the nozzle exit plane, which has been previously proposed and verified as the physical mechanism of screech generation. The detailed calibration tests, conducted prior to the main shock-associated noise experiments, established that all results are essentially uncontaminated by the presence of screech. GRA

N77-25180# Pennsylvania State Univ., University Park. Applied Research Lab.

NOISE DUE TO INTERACTION OF BOUNDARY LAYER TURBULENCE WITH A COMPRESSOR OR A PROPULSER ROTOR

N. Moiseev, B. Lakshminarayana, and D. E. Thompson 27 Aug. 1976 50 p refs

(Contract N00017-73-C-1418)

(AD-A033199; TM-76-241) Avail: NTIS HC A03/MF A01 CSCL 20/4

The radiated sound due to a compressor or propulsor rotating blade row was investigated under various operating conditions and inflows. The propulsor was operated in air with different blade space-to-chord ratios, different flow coefficients and differing turbulence 'non-isotropic) inflows. The inflows ingested are: (1) the natural boundary layer on the hub and annulus wall, (2) a tripped boundary layer on the hub, and (3) a fully developed boundary layer on the hub. The turbulence properties were also altered by placing a grid at the inlet. The mean velocity profiles, turbulence intensities, length scales, and energy spectra of the inflow were measured, as well as near and far-field acoustic spectra. A parametric investigation of the effect of inflow characteristics on the radiated sound has been made. Several length scales were found to exist simultaneously. The noise due to small scale turbulence seems to depend on, i.e., turbulence velocity normal to the blade divided by the axial length scale. The long eddies are also responsible for discrete tone production. Author (GRA)

N77-25181# General Electric Co., Wilmington, Mass. Dept. of Aerospace Instruments and Product Support.

SOLID STATE VERTICAL SCALE INDICATOR FOR ENGINE PERFORMANCE INDICATION Final Report, 13 Nov. 1975 - 28 Sep. 1976

G. M. Gozemba and R. L. Skovholt Oct. 1976 26 p

(Contract N62269-76-C-0109)

(AD-A036154; DF76AEE228; NADC-75219-50) Avail: NTIS HC A03/MF A01 CSCL 01/4

The work performed on an evaluation sample of a totally solid state engine performance instrument is presented. The particular application is a six channel indicator with each parameter displayed as a bargraph and a redundant numeric. The display medium is gallium arsenide phosphide (GaAsP) LED emitting light in the red spectrum. Emphasis is given on characteristics and the performance of an evaluation unit. Author (GRA)

N77-25182# Naval Air Test Center, Patuxent River, Md.

AIRCRAFT ENGINE DRIVEN ACCESSORY SHAFT COUPLING IMPROVEMENTS USING HIGH-STRENGTH, LOW WEAR POLYIMIDE PLASTIC

Aleck Loker 30 Dec. 1976 34 p refs

(AD-A035301; NATC-TM-76-1-SY) Avail: NTIS HC A03/MF A01 CSCL 21/5

Splined shaft couplings which connect generators, pumps, starters, and other accessories to aircraft engines and gearboxes frequently exhibit high wear and failure rates. In an effort to improve aircraft safety, reliability, and readiness, the Naval Air Test Center has engaged in a continuing spline improvement program over the past 9 years. This Technical Memorandum describes the development and test of two unique spline coupling modifications which have proven to be essentially immune to wear and failure, in the aircraft power transmission applications which have been evaluated. Specific design information and application concepts are discussed to introduce this new spline coupling technology to mechanical equipment designers.

Author (GRA)

N77-25183# Southwest Research Inst., San Antonio, Tex.

INVESTIGATION OF GREASE-LUBRICATED EXPENDABLE SPLINE CONNECTIONS Final Report, Jan. 1975 - Oct. 1976

M. L. Valtierra 20 Oct. 1976 60 p refs

(Contract N68335-75-C-1117)

(AD-A035296; SwRI-RS-650) Avail: NTIS HC A04/MF A01 CSCL 21/5

The objective of this program was to evaluate the feasibility of three basic arrangements of expendable spline connections, namely the 'standard,' the 'dogbone,' and the 'muff' splines. Spline wear tests were performed with three SwRI spline wear testers, operated under controlled angular misalignment, torque, temperature, and speed conditions, using a MIL-G-81322B grease. Standard, dogbone, and muff spline test specimens of various material and hardness combinations were used, some with varied metallic coatings and designs. The basic objective of this program was accomplished, i.e., to show that the 'expandable spline' concept can be used to advantage, to extend the wear life of grease-lubricated steel interface spline connections. GRA

N77-25184# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.

VARIABLE CYCLE ENGINE CONTROL SYSTEM DEFINITION STUDY. TURBINE ENGINE TECHNOLOGY DEMONSTRATOR COMPONENT DEVELOPMENT PROGRAM, PROJECT 678A: CONTROLS DEVELOPMENT PROGRAM Final Technical Report, Jul. 1973 - Mar. 1976

Robert C. Boxer and Jay D. Meador Mar. 1976 198 p

(Contract F33657-73-C-0618; AF Proj. 668A)

(AD-A036175; DDA-EDR-8836; AFAPL-TR-76-49) Avail: NTIS HC A09/MF A01 CSCL 21/5

The primary objective of this Air Force funded program was the development of a control mode for a Joint Technology Demonstrator (JTD) engine that achieves 'optimal' steady state performance (minimum sfc and maximum thrust) with rapid transient performance over the entire flight envelope of a hypothetical transonic/supersonic aircraft. A flexible digital computer simulation of the JTD turbofan engine with a control system was developed along with computerized optimization and constraint procedures to establish optimal engine operating conditions and variable geometry positions to achieve minimum sfc and maximum thrust. Speed and turbine temperature fuel governors along with a compressor Mach Number (delta P/P) surge control loop in the fuel control were evaluated. A control mode that positioned the geometry to 'scheduled' optimal geometry settings was unable to achieve steady state maximum thrust over the entire flight envelope. However, a control mode developed to force engine parameters to 'scheduled' optimal parametric relationships successfully attained minimum sfc and maximum thrust at all the selected test points in the flight envelope. Since certain parametric relationships are true for minimum sfc (i.e., maximum airflow and minimum temperature for a given thrust) and maximum thrust (i.e., maximum speed, temperature, and pressure within engine limits), the control based upon parametric relationships will yield maximum thrust and near minimum sfc for a resonable range of engine variation. Therefore, it is not necessary to tune each new engine for maximum thrust or adjust the control for engine aging. GRA

N77-25185# Solar, San Diego, Calif.

APPLICATION OF CERAMIC NOZZLES TO 10kW ENGINE Interim Report, 7 Mar. 1975 - 17 Aug. 1976

J. C. Napier and A. G. Metcalfe Aug. 1976 191 p refs

(Contract DAAK02-75-C-0138)

(AD-A035329; RDR-1797-16) Avail: NTIS HC A09/MF A01 CSCL 21/5

This report covers work for application of ceramics to the nozzle section of the small radial MERADCOM 10kW gas turbine engine. Engine simulator tests of a HPSi3N4 ceramic-vane/superalloy-shroud nozzle for improved erosion resistance are described. Engine test results of the same nozzle are also documented. Engine simulator tests of a simplified all-ceramic nozzle section, including HPSi3n4 vanes and RBSi3N4 shrouds are also documented. Special glass adhesives for joining of ceramics are studied. Program results show thermal shock and corrosion resistance of ceramics to be adequate to meet operating environment of the engine. Erosion resistance of HPSi3N4 vanes has been shown to be one to two orders of magnitude superior to 713LC superalloy at 1700 F turbine inlet temperature.

Author (GRA)

N77-25186# Naval Ship Research and Development Center, Bethesda, Md.

EXPERIMENTAL INVESTIGATION OF THE EFFECT OF PROPELLER BLADE PITCH ON PROPELLER-PRODUCED UNSTEADY BEARING FORCES AND MOMENTS

D. T. Valentine and R. D. Kader Dec. 1976 63 p refs

(SF43452702)

(AD-A035756; DTNSRDC-76-0137) Avail: NTIS HC A04/MF A01 CSCL 13/10

Experimental results are presented to show the effect of pitch-diameter ratio on propeller-produced unsteady loads. Eight three-bladed propellers with changes of equal increments of pitch resulting in pitch-diameter ratios from 0.58 to 1.75 were tested in three-cycle and four-cycle wake screens. The data indicated that, in general, for the same thrust loading coefficient C sub Th, the unsteady thrust and bending moments tend to decrease with increasing pitch whereas the torque increases and the side forces change negligibly. However, it is impracticable to reduce unsteady thrust by altering pitch. GRA

N77-25187# Boeing Vertol Co., Philadelphia, Pa.
TRANSMISSION CONDITION ASSESSMENT Final Report
O. L. Sandora Dec. 1976 183 p refs
(Contract DAAJ02-75-C-0021)
(AD-A035215; D210-11067-1; USAAMRDL-TR-76-36) Avail: NTIS HC A09/MF A01 CSCL 13/9

This program was conducted to provide the correlation and analysis of vibration signatures, component condition and oilborne debris from 38 CH-47C rotor transmissions tested under a spectrum of load conditions. The transmission tested included new, postoverhaul, and preoverhaul scheduled and unscheduled removals. The analysis of data shows the relative diagnostic accuracies of transmission condition assessment by analysis of particulate debris from filters and by spectral analysis of demodulated high-frequency vibration. Author (GRA)

N77-25188# RAND Corp., Santa Monica, Calif.
STRATEGIC DEFENSE MATERIALS: A CASE STUDY OF HIGH TEMPERATURE ENGINES Interim Report
Richard G. Salter, Corey Dzitzer, Elwyn D. Harris, William E. Mooz, and Kathleen A. Wolf Feb. 1977 103 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189)
(AD-A037493; R-1970-ARPA) Avail: NTIS MF A01 CSCL 05/1

Recent short-term commodity shortages and the potential for interruption of our supplies have caused concern that future U.S. defense systems may become increasingly dependent on materials that are potentially in short supply. This study inquires specifically into the prospects for material to be applied in the first stage turbine of man-rated military aircraft in 1990. The set of candidate material technologies that are in prospect is defined, and the component materials of these technologies that are potentially future supply problems are determined. A methodology was developed to combine the range of technology risks with the range of materials availability risks and overall comparisons were made. Due to the significant availability risks of chromium (as a necessary constituent of superalloys), ceramic materials appear to have the lowest long-term risks for high temperature engines. Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-25189*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF SEPARATION OF THE SPACE SHUTTLE ORBITER FROM A LARGE TRANSPORT AIRPLANE
Alan W. Wilhite Jun. 1977 24 p refs
(NASA-TM-X-3492; L-11074) Avail: NTIS HC A02/MF A01 CSCL 01D

The feasibility of safely separating the space shuttle orbiter (140A/B) from the top of a large carrier vehicle (the C-5 airplane) at subsonic speeds was investigated. The longitudinal equations of motion for both vehicles were numerically integrated using a digital computer program which incorporates experimentally derived interference aerodynamic data to analyze the separation maneuver for various initial conditions. Separation of the space shuttle orbiter from a carrier vehicle was feasible for a range of dynamic-pressure and flight-path-angle conditions. By using an autopilot, the vehicle attitudes were held constant which ensured separation. Carrier-vehicle engine thrust, landing gear, and spoilers provide some flexibility in the separation maneuver. Author

N77-25190# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
SOLVING AEROELASTIC PROBLEMS FOR THE MRCA-TORNADO FLIGHT CONTROLLER [LOESUNG AEROELASTISCHER PROBLEME BEIM MRCA-TORNADO FLUGREGLER]
O. Sensburg 23 Sep. 1976 16 p refs In GERMAN Presented at the Wehrtech. Symp. Flugtech. 1 'Einige Moderne Aspekte der Kampfflugzeugentwicklung', Mannheim, West Ger., 4-5 Oct. 1976
(MBB-UFE-1275-0) Avail: NTIS HC A02/MF A01

A method used for the MRCA-Tornado combat aircraft to avoid coupling between the Command and Stability Augmentation System (CSAS) stability controller and the aeroelastics of the aircraft is described. ESA

N77-25191# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
INTEGRATED CONTROLLER EVALUATION Final Report
Charles L. Thomas, Mathew S. Mathews, III, and Arnold R. James Sep. 1976 64 p refs
(AD-A035064; USAAEFA-75-24) Avail: NTIS HC A04/MF A01 CSCL 01/2

The United States Army Aviation Engineering Flight Activity, in conjunction with the United States Army Human Engineering Laboratory (USAHEL), conducted a limited flight evaluation of an integrated control system installed in a JOH-58A helicopter. Flight tests were conducted at Aberdeen Proving Ground, Maryland, from 23 January through 19 February 1976. A total of 27 flights were conducted, consisting of 14 productive flight hours. Testing was performed to provide a safety-of-flight envelope for future USAHEL tests, to determine the feasibility of the integrated controller concept, and to verify satisfactory operation of standard flight controls (right side) with the integrated flight control system installed. A safety-of-flight envelope was established for future USAHEL testing. The integrated controller concept could not be adequately evaluated because of the large number of shortcomings and deficiencies found with the initial design. Eight shortcomings and five deficiencies were noted during this evaluation. The most significant were the high control sensitivity in all controls and the poor control harmony between control axes. The standard control operated satisfactorily in conjunction with the integrated controller. Author (GRA)

N77-25056# Systems Technology, Inc., Hawthorne, Calif.
A HISTORICAL PERSPECTIVE FOR ADVANCE IN FLIGHT CONTROL SYSTEMS
Duane McRuer and Dunstan Graham (Princeton Univ., New Jersey) *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 7 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25057# Sperry Flight Systems, Phoenix, Ariz.
CHRONOLOGICAL OVERVIEW OF PAST AVIONIC FLIGHT CONTROL SYSTEM RELIABILITY IN MILITARY AND COMMERCIAL OPERATIONS
S. S. Osder *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 17 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25058# Civil Aviation Authority, Redhill (England).
SAFETY CRITERIA FOR FAIL-OPERATIONAL AUTOLAND SYSTEMS AND THEIR APPLICATION
D. V. Warren *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 9 p ref (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25059# Boeing Co., Wichita, Kans.
FUTURE TRENDS IN HIGHLY RELIABLE SYSTEMS
James I. Arnold *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 14 p refs (For primary document see

N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25066# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
FAILURE SELF-DETECTION IN DIGITAL FLIGHT GUIDANCE SYSTEMS
H. Drtil and W. Meyer *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 7 p (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25067# Boeing Co., Houston, Tex.
SNEAK CIRCUIT ANALYSIS APPLICATION TO CONTROL SYSTEM DESIGN
Joe L. Wilson and Robert C. Clardy *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 6 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25068# Honeywell, Inc., St. Louis Park, Minn.
BUILT-IN TEST TECHNIQUES FOR DIGITAL FLIGHT CONTROL SYSTEMS
W. A. Plice *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 13 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25069# Wales Univ. Inst. of Science and Technology, Cardiff.
PRE-FLIGHT DYNAMIC CHECKOUT
D. R. Towill *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 15 p refs Sponsored by the UK Ministry of Defence and the UK Sci. Res. Council (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25073# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Control Systems Development Branch.
OBJECTIVES FOR THE DESIGN OF IMPROVED ACTUATION SYSTEMS
B. H. Earley *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 16 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25074# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
F-16 FLIGHT CONTROL SYSTEM DEVELOPMENT
David L. Carleton *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 9 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25075# Honeywell, Inc., St. Louis Park, Minn. Government and Aeronautical Products Div.
JA-37 DIGITAL AUTOMATIC FLIGHT CONTROL SYSTEM (DAFCS)
D. G. Bailey and Kjell Folkesson (SAAB SCANIA, Linkoping, Sweden) *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 11 p (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25076*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
DESIGN AND TEST EXPERIENCE WITH A TRIPLY REDUNDANT DIGITAL FLY-BY-WIRE CONTROL SYSTEM
Kenneth J. Szalai, Philip G. Fellemen (Charles Stark Draper Lab., Inc.), Joseph Gera (NASA Langley Res. Center), and Richard D. Glover (NASA Johnson Space Center) *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 30 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25077# Lockheed-California Co., Burbank.
L-1011 FLIGHT CONTROL SYSTEM
J. A. Flapper and E. O. Throndsen *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 24 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25078# Aerospatiale Usines de Toulouse (France).
FLIGHT CONTROLS FOR THE CONCORDE [LES COMMANDES DE VOL DE CONCORDE]
M. Bossard and R. Deque *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 12 p In FRENCH (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25079# Royal Aircraft Establishment, Farnborough (England). Dept. of Flight Systems.
A HIGH-RELIABILITY, HIGH INTEGRITY FLIGHT CONTROL SYSTEM FOR HELICOPTERS
P. Robinson, J. Mesdows (Smiths Industries Ltd., Gloucestershire, Engl.), and C. M. Copage (Smiths Industries Ltd., Gloucestershire, Engl.) *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 15 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N77-25192# Bari Univ. (Italy). Ist. di Macchine.
TEST BENCH FOR FATIGUE TESTS ON AXLES
L. Vasciaveo Bologna Assoc. Ital. di Anal. delle Sollecitazioni 1975 13 p refs In ITALIAN; ENGLISH summary Presented at the 3d Convegno Nazl. Assoc. Ital. di Anal. delle Sollecitazioni, Bologna, 1975
Avail: NTIS HC A02/MF A01

The properties of a bench for fatigue tests on axles for wheel loaders are outlined. The bench applies the stresses of torsion and bending recorded during simple braking tests in the field. The bench seems to be useful also for testing motor vehicle axles. ESA

N77-25193# Edgewood Arsenal, Aberdeen Proving Ground, Md.
THE CHARACTERIZATION OF GRID TURBULENCE FOR TURBULENT IMPACTION EXPERIMENTS Technical Report, Jun. 1969 - Dec. 1970
William A. Cooper Nov. 1976 88 p refs
(DA Proj. 1W7-62718-A-08402)
(AD-A033470; EC-TR-76076) Avail: NTIS HC A05/MF A01 CSCL 20/4

An Eulerian description of the turbulent flow field produced by passing air through a uniformly spaced square-mesh grid was characterized by measurements of the relative intensity of the longitudinal velocity fluctuations and the autocorrelation function at various distances from the grid. The autocorrelation functions were analyzed to discern the classical Taylor microscale and macroscale in the turbulent flow. The microscale of turbulence was also obtained from the mean square of the time differentiation of the hot-wire anemometer output for comparison. A graphical analytical Fourier transform technique was used to obtain the turbulent energy distribution of the flow field. The experiments were carried out in a 24 by 30 by 72-inch test section of a low-speed, open-circuit wind tunnel. Four periodic square mesh grids have been characterized: a 3- and 4-inch-mesh monoplane grid with 1-inch-diameter rods; a 1.375-inch-mesh monoplane grid with 0.375-inch-diameter rods, and a 0.625-inch-mesh biplane grid with 0.125-inch-diameter rods. GRA

N77-25194# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
TRANSONIC FLOW AT A SLOTTED TEST SECTION WALL Final Report, 1 Oct. 1971 - 30 Sep. 1976
Sune B. Berndt 29 Nov. 1976 17 p refs

(Grant AF-AFOSR-2184-72; AF Proj. 9781)
(AD-A035308; AFOSR-77-0035TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

The objective of the now concluded research has been to make possible the accurate computation of slotted walls interference in transonic wind-tunnels. This has been achieved through studying experimentally the flow at and through slotted walls and through developing theoretical models for such flows. The final result is a homogenous wall boundary condition to be used when computing numerically the three-dimensional transonic flow around a wind-tunnel model, be it to determine the interference from the test-section walls or to adjust the wall parameters for zero interference. The boundary condition is of rather general applicability, admitting great freedom in the choice of slot geometry and facilitating the inclusion of corrections for viscous effects, such as disclosed by the experiments.
Author (GRA)

N77-25195# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
PLASTIC AND RESILIENT PROPERTIES OF HEAVY CLAY UNDER REPETITIVE LOADING Final Report, Aug. 1974 - Sep. 1975
Frank C. Townsend and Ed E. Chisolm Nov. 1976 70 p refs
(Contract DOT-FA73WAI-377; DA Proj. 4A7-62719-AT-40)
(AD-A035035; WES-TR-S-76-16; FAA-RD-76-107) Avail: NTIS HC A04/MF A01 CSCL 01/5

This investigation was conducted to determine the effect of specimen stiffness on the relationship between elastic and plastic strain, rutting potential, and resilient modulus and Poisson's ratio of heavy clay. Specimens were compacted to various California Bearing Ratio (CBR) values and subjected to either 1,000 or 50,000 repetitive stress applications in a triaxial compression chamber. The plastic and recoverable strains were monitored from which the rutting potential and resilient modulus could be determined. CBR and unconfined compression strength (USC) tests were conducted for supplemental information. The relationship between elastic and plastic strain is dependent upon specimen stiffness. Poisson's ratio was found to be insensitive to number and magnitude of repetitive stress applications, confining pressure, and specimen stiffness. GRA

N77-25196# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ENVIRONMENT AND RADAR OPERATION SIMULATOR Quarterly Report, 1 Apr. - 30 Jun. 1976
S. N. Cole and B. S. Rice Sep. 1976 28 p
(Contract DAAB07-74-C-0272; DA Proj. 1S7-62703-DH-93)
(AD-A035758; ECOM-74-0272-8) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report summarizes activities during the eighth quarter of a program sponsored by the U.S. Army Electronics Command (ECOM) directed toward the design of an Environment and Radar Operation Simulation (EROS). In addition some of the analysis results and design decisions are described in detail. Algorithms for estimating the mean and variance of the filter outputs is described. The estimation takes into account the effects of multiplier truncation errors. The mean and variance are expressed in terms of the radar cross sections of the fixed and moving portions of simulated clutter, and the spectral parameters of the filter therefore impose limits on the magnitude of radar cross section that can be simulation. Tabulated results are presented.
Author (GRA)

N77-25197# Naval Postgraduate School, Monterey, Calif.
INTERNAL AERODYNAMICS OF TURBOJET TEST CELLS Final Report
Glendon C. Speakman, Jack D. Hayes, and David W. Netzer Dec. 1976 66 p refs
(AD-A035253; NPS-67NT76121) Avail: NTIS HC A04/MF A01 CSCL 01/1

Elliptic computer codes have been developed (including plot routines) which can be used to study the flow field in test cells and exhaust stacks and in the augmenter tube for low thrust operation. The effects of engine-augmenter spacing, augmenter diameter and inlet design, aft cell wall location, test cell by-pass ratio, cell inlet conditions and stack-augmenter geometry on the flow field and augmenter pressure rise have been calculated. The models appear to be qualitatively correct and adequate for their intended purposes but model validation with experiment is required. Author (GRA)

N77-25198# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
SUMMARY OF BUCKLING AND TENSION TESTS OF LANDING MATS AS RELATED TO C-5A AIRCRAFT BOW WAVE PROBLEMS Final Report, Jan. - Jun. 1976
Hugh L. Green and Carroll J. Smith Jan. 1977 48 p refs
(DA Proj. 1T1-62112-A-528)
(AD-A037000; WES-MP-S-77-1) Avail: NTIS HC A03/MF A01 CSCL 01/5

In order to better understand and define the problems associated with the C-5a and landing mat, several investigations were conducted at the U.S. Army Engineer Waterways Experiment Station and Utah State University to study the characteristics of landing mats subjected to horizontal C-5A loads. Several mat configurations with various connector designs were evaluated in buckling, skid. joint slack, and traffic tests. Mats both with and without water seals were used in the tests; however, the heavy-duty truss web mat designs with their extra weight and additional strength were given primary consideration. In the buckling tests conducted, it was determined that panel width, mat unit weight, and formation width were factors which affect the buckling load of a mat system. The horizontal load at which buckling occurs depends almost exclusively on the vertical eccentricities existing in the mat system at the time the load is applied. These eccentricities or irregularities could be initiated by the presence of warped panels, damaged joints, uneven subgrade, etc. It is concluded that the approximately square truss web mat designs sustained a much higher load per foot of width prior to the development of a bow wave or buckling. Square mats without water seals give higher resistance to sliding between mat rows that mats with seals. However, membrane beneath mat provides a lower coefficient of friction which enhances mat sliding. During the normal placement of mat, there is free slack in the panel joints which, although necessary for contraction and expansion, contributes to potential runway movement. GRA

N77-25199# Pennsylvania State Univ., University Park. Applied Research Lab.
DESIGN CONCEPTS FOR A FREE SURFACE FLOW TEST TUNNEL
J. S. Talian 8 Feb. 1977 60 p refs
(Contract N00017-73-C-1418)
(AD-A037239; TM-77-33) Avail: NTIS HC A04/MF A01 CSCL 20/4

A proposal was made to build a free surface flow test facility at the Garfield Thomas Water Tunnel. This facility was to be built by the conversion of the rectangular test section of one of the existing tunnels. As the project was begun a literature search was conducted to determine the state-of-the-art of free surface test sections. A testing program was then initiated and some design ideas were considered. This is a report of all the relevant work that has been completed to date. Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-25200*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TEST EFFECTIVENESS STUDY REPORT: AN ANALYTICAL STUDY OF SYSTEM TEST EFFECTIVENESS AND RELIABILITY GROWTH OF THREE COMMERCIAL SPACECRAFT PROGRAMS Final Report
J. F. Feldstein Mar. 1977 200 p refs
(Contract NASw-2949)
(NASA-CR-153212; D8234; SCG-70103R) Avail: NTIS HC A09/MF A01 CSCL 22A

Failure data from 16 commercial spacecraft were analyzed to evaluate failure trends, reliability growth, and effectiveness of tests. It was shown that the test programs were highly effective

in ensuring a high level of in-orbit reliability. There was only a single catastrophic problem in 44 years of in-orbit operation on 12 spacecraft. The results also indicate that in-orbit failure rates are highly correlated with unit and systems test failure rates. The data suggest that test effectiveness estimates can be used to guide the content of a test program to ensure that in-orbit reliability goals are achieved. Author

N77-25201*# General Electric Co., Philadelphia, Pa. Space Div.
STUDY FOR IDENTIFICATION OF BENEFICIAL USES OF SPACE (BUS). VOLUME 2: TECHNICAL REPORT. BOOK 1: DEVELOPMENT AND BUSINESS ANALYSIS OF SPACE PROCESSED ISOENZYMES Final Report
30 Nov. 1975 103 p refs 3 Vol.
(Contract NAS8-28179)
(NASA-CR-150288; DOC-75SDS4281-Vol-2-Bk-1) Avail: NTIS HC A06/MF A01 CSCL 22A

A separation method to provide reasonable yields of high specificity isoenzymes for the purpose of large scale, early clinical diagnosis of diseases and organic damage such as, myocardial infarction, hepatoma, muscular dystrophy, and infectous disorders is presented. Preliminary development plans are summarized. An analysis of required research and development and production resources is included. The costs of such resources and the potential profitability of a commercial space processing opportunity for electrophoretic separation of high specificity isoenzymes are reviewed. B.B.

N77-25202*# General Electric Co., Philadelphia, Pa. Space Div.
STUDY FOR IDENTIFICATION OF BENEFICIAL USES OF SPACE (BUS). VOLUME 2: TECHNICAL REPORT. BOOK 2: DEVELOPMENT AND BUSINESS ANALYSIS OF SPACE PROCESSED TRANSPARENT OXIDES Final Report
30 Nov. 1975 84 p refs 3 Vol.
(Contract NAS8-28179)
(NASA-CR-150289; DOC-75SDS4281-Vol-2-Bk-2) Avail: NTIS HC A05/MF A01 CSCL 22A

The potential profitability of a commercial space processing opportunity for the production of transparent forms of certain metallic oxides was studied. Author

N77-25203*# General Electric Co., Philadelphia, Pa. Space Div.
STUDY FOR IDENTIFICATION OF BENEFICIAL USES OF SPACE (BUS). VOLUME 2: TECHNICAL REPORT. BOOK 3: DEVELOPMENT AND BUSINESS ANALYSIS OF SPACE PROCESSED TUNGSTEN FOX X-RAY TARGETS Final Report
30 Nov. 1975 97 p refs
(Contract NAS8-28179)
(NASA-CR-150290; DOC-75SDS4281-Vol-2-Bk-3) Avail: NTIS HC A05/MF A01 CSCL 22A

The development plans, analysis of required R and D and production resources, the costs of such resources, and finally, the potential profitability of a commercial space processing opportunity for containerless melting and resolidification of tungsten are discussed. The aim is to obtain a form of tungsten which, when fabricated into targets for X-ray tubes, provides at least, a 50 percent increase in service life. Author

N77-25204*# General Electric Co., Philadelphia, Pa. Space Div.
STUDY FOR IDENTIFICATION OF BENEFICIAL USES OF SPACE (BUS). VOLUME 2: TECHNICAL REPORT. BOOK 4: DEVELOPMENT AND BUSINESS ANALYSIS OF SPACE PROCESSED SURFACE ACOUSTIC WAVE DEVICES Final Report
30 Nov. 1975 105 p refs 3 Vol.
(Contract NAS8-28179)
(NASA-CR-150291; DOC-75SDS4281-Vol-2-Bk-4) Avail: NTIS HC A06/MF A01 CSCL 22A

Preliminary development plans, analysis of required R and D and production resources, the costs of such resources, and, finally, the potential profitability of a commercial space processing opportunity for the production of very high frequency surface acoustic wave devices are presented. Author

N77-25205*# General Electric Co., Philadelphia, Pa. Space Div.
STUDY FOR IDENTIFICATION OF BENEFICIAL USES OF SPACE (BUS). VOLUME 2: TECHNICAL REPORT. BOOK 5: STUDY METHODS AND TRADE STUDIES Final Report
30 Nov. 1975 104 p refs 3 Vol.
(Contract NAS8-28179)
(NASA-CR-150292; DOC-75SDS4281-Vol-2-Bk-5) Avail: NTIS HC A06/MF A01 CSCL 22A

A glossary of terms, a work breakdown structure, and work element descriptions, resource needs, and costs are introduced. The generic work breakdown structure was utilized to organize specific structures for each product under study; each structure containing both space and ground elements arrived at via mutual interaction. Concept definition and assessment, provided the study team and the participants visibility of the limits, and the organization of the efforts provided by both groups spelling out where such efforts fit into the generation of processing concepts. Author

N77-25206*# General Electric Co., Philadelphia, Pa. Space Div.
STUDY FOR IDENTIFICATION OF BENEFICIAL USES OF SPACE (BUS). VOLUME 3: APPENDICES Final Report
30 Nov. 1975 26 p refs 3 Vol.
(NASA-CR-150293; DOC-75SDS4281-Vol-3-App) Avail: NTIS HC A03/MF A01 CSCL 22A

The quantification of required specimen(s) from space processing experiments, the typical EMI measurements and estimates of a typical RF source, and the integration of commercial payloads into spacelab were considered. S.M.

N77-25207*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HEAO-A OBSERVATORY DESCRIPTION
Carroll Dailey and Thomas A. Parnell Apr. 1977 41 p
(NASA-TM-X-73396) Avail: NTIS HC A03/MF A01 CSCL 22A

The High Energy Astronomy Observatory Program is briefly described to introduce guest observers to the HEAO-A mission. Topics discussed include spacecraft subsystems, scientific instrumentation, and the mission operations concept. Scientific participants such as principal investigators and co-investigators are listed. Author

N77-25208*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Analysis Section.
FORMULATION OF CONSUMABLES MANAGEMENT MODELS: TEST PLAN FOR THE MISSION PLANNING PROCESSOR WORKING MODEL
L. C. Connelly 30 May 1977 23 p refs
(Contract NAS9-14264)
(NASA-CR-151433; TRW-26821-H017-R0-00) Avail: NTIS HC A02/MF A01 CSCL 22A

The test plan and test procedures to be used in the verification and validation of the software being implemented in the mission planning processor working model program are documented. The mission planning processor is a user oriented tool for consumables management and is part of the total consumables subsystem management concept. An overview of the working model is presented. Execution of the test plan will comprehensively exercise the working model software. An overview of the test plan, including a testing schedule, is presented along with the test plan for the unit, module, and system levels. The criteria used to validate the working model results for each consumables subsystem is discussed. Author

N77-25209*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY PHYSICS LABORATORY (IPL): A CONCEPT FOR AN INTERPLANETARY MISSION IN THE MID-EIGHTIES
L. F. Burlaga, K. W. Ogilvie, and W. Feldman (LASL) May 1977 34 p refs

(NASA-TM-X-71328; X-692-77-110) Avail: NTIS HC A03/MF A01 CSCL 22A

A concept for a near-earth interplanetary mission in the mid-eighties is described. The proposed objectives would be to determine the composition of the interplanetary constituents and its dependence on source-conditions and to investigate energy and momentum transfer processes in the interplanetary medium. Such a mission would accomplish three secondary objectives: (1) provide a baseline for deep space missions, (2) investigate variations of the solar wind with solar activity, and (3) provide input functions for magnetospheric studies. Author

N77-25210*# Oak Ridge National Lab., Tenn.
SURFACE TENSION INDUCED CONVECTION IN ENCAPSULATED LIQUID METALS IN MICROGRAVITY: APOLLO-SOYUZ TEST PROJECT EXPERIMENT NO. MA-041
R. E. Reed, H. L. Adair, and W. Uelhoff Dec. 1976 29 p refs Sponsored by NASA
(Contract W-7405-eng-26)
(NASA-CR-153258; ORNL-TM-5480) Avail: NTIS HC A03/MF A01 CSCL 22A

This experiment was designed to determine the extent of surface tension induced convection caused by a steplike compositional variation in a liquid metal. Preliminary results are presented. ERA

N77-25211# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
HEAT TRANSFER EXPERIMENTS WITH LIQUID HELIUM IN SPACELAB
A. A. M. Delil and J. F. Heemskerk 8 Oct. 1976 51 p refs
(Contract NIVR-1818)
(NLR-TR-76095-U) Avail: NTIS HC A04/MF A01

The experiment described is proposed for the first Spacelab mission. Its scientific goal is the study of heat transfer to liquid helium above and below the lambda point under nearly zero gravity conditions. Technological results to be expected are in the field of cooling with cryogens and management of cryogens in space. An outline of the experimental apparatus is presented, and estimated development activities, required facilities, and a time schedule are described. Author (ESA)

N77-25212# Centre National d'Etudes Spatiales, Toulouse (France).
FIRST SPACELAB PAYLOAD: MODEL ACCOMMODATION STUDY
Nov. 1976 114 p refs Prepared jointly with DFVLR, Porz, West Ger.
(Contract ESA-SC/123-HQ)
(ESA-CR(P)-914) Avail: NTIS HC A06/MF A01

A payload accommodation study for the first Spacelab flight is presented. Mandatory European facilities are considered, i. e., space sled, metric camera, and material sciences console, as well as proposed facilities such as CAPS and the microwave experiment. The NASA payload is also accounted for. Aspects studied are option definition, physical arrangements, preliminary payload investigation, weight budget, center of gravity location, first electrical power distribution and interfaces, compatibility between sled and other experiments, and data management investigation. ESA

N77-25213# European Space Agency, Paris (France).
REPORT PRESENTED TO THE TWENTIETH COSPAR MEETING
K.-P. Wenzel, comp. May 1977 258 p refs Conf. held at Tel Aviv, Israel, Jun. 1977 Original contains color illustration
(ESA-SP-1002) Avail: NTIS HC A12/MF A01

Descriptions and results from ESA satellites in orbit or decayed are presented together with a survey of projects under development. These include GEOS, ISEE, METEOSAT, IUE, GEOSARI, first SPACELAB payload, EXOSAT, and ESA's participation in the NASA Space Telescope Program. Projects under study are also commented on and a bibliography is included. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N77-25214*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Houston Astronautics Div.
SMOOTHING OF ORBITAL TRACKING DATA: MISSION PLANNING, MISSION ANALYSIS AND SOFTWARE FORMULATION
J. D. Vedder 16 May 1977 22 p refs
(Contract NAS9-14960)
(NASA-CR-151363; DN-1.4-8-018) Avail: NTIS HC A02/MF A01 CSCL 22A

The problem created by the presence of wild or outlying data points among orbital tracking data, is addressed. Consideration is given to the effects of such outliers on the orbit determination process, and methods for minimizing or even eliminating these effects are proposed. Some preliminary efforts implementing these new methods are described, and the results thus far obtained are summarized. Based on these ideas and results, recommendations are made for future investigation. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N77-25215# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
[ACTIVITIES OF THE DFVLR] Annual Report 1975
[1976] 95 p In GERMAN Original contains color illustrations
Avail: NTIS HC A05/MF A01

Results obtained in the fields of traffic and communication system, aerospace engineering, remote sensing, and other advanced technologies are described. Activities of the various departments are reported. ESA

N77-25216# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ISEE-B PROJECT: ELECTRONIC STATION FOR GROUND INTEGRATION OF THE EGD EXPERIMENT [ISE-B PROJECT: STAZIONE ELETTRONICA PER L'INTEGRAZIONE A TERRA DELL'ESPERIMENTO EGD]
C. Bonifazi and G. Farina Sep. 1976 83 p refs In ITALIAN
(LPS-76-22) Avail: NTIS HC A05/MF A01

The ground support equipment (GSE) for the EGD solar wind experiment on board the ISEE daughter satellite is described in detail. The GSE provides all the signal necessary for the operation of the experiment, substituting those provided by the satellite's subsystems. The operation of the experiment is followed by using a printer and a computer to which the GSE can be connected. ESA

N77-25217# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
PRESENT STATUS OF THE SATELLITE OBSERVATION STATION WETTZELL [ZUR BISHERIGEN BILANZ DER SATELLITENBEOBACHTUNGSSTATION WETTZELL]
Hermann Seeger, Peter Wilson, Klemens Nottarp, and Dieter Leigemann 1976 28 p refs In GERMAN; ENGLISH summary Presented at the 60th Deut. Geodaetentag, Munich, 1-4 Sep. 1976 Sponsored in part by Bundesmin. des Innern and Deut. Forschungsgemeinschaft Prepared jointly with Tech. Univ., Munich
Avail: NTIS HC A03/MF A01

The observation station for satellite geodesy in the Bavarian Forest (Germany) is described. Its observation equipment includes a laser ranging system (Neodymium-yag laser), a VHF Doppler

system for reception of frequencies of the Navy Navigation Satellite System, a VHF Doppler system for reception of GEOS frequencies, ballistic cameras, and a C-band radar system. ESA

N77-25218# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
A MAGNETIC-GUIDEWAY/GUIDED-PROJECTILE SYSTEM CONCEPT FOR AEROBALLISTIC RANGES Final Report, Jul. 1973 - Feb. 1976
George D. Arney, Jr. and Charles W. Pender, Jr. AEDC Feb. 1977 102 p refs
(AD-A036157; ARO-VKF-TR-76-24; AEDC-TR-76-149) Avail: NTIS HC A06/MF A01 CSCL 17/7

A system concept for the incorporation of magnetic projectile guidance into aeroballistic ranges is presented and analyzed. Basis of the concept is motion-induced, electrodynamic interaction between conductive material in the projectile's forebody and a guideway of field source currents. Theory is developed for deployment of the currents such that on the one hand the forebody will be repulsed toward the guideway centerline as a function of error in lateral position whereas, on the other hand, there will be damping of resulting lateral motion. Expressions are subsequently derived which interrelate the magnitude of forces to the magnitude of guideway currents, and generalized equations of motion for the projectile are developed with both electrodynamic and aerodynamic forces being considered. A design example is included wherein the developed theory is correlated to an existing aeroballistic range (AEDC/VKF Range G) where projectiles with base diameters on the order of 0.05 m are launched at velocities of 4,000 to 6,000 m/sec. Results are gratifying in that computed flight paths for varying conditions indicate that stable guided flight can be achieved with guideway currents of reasonable magnitude. Practical means of providing these are discussed. Author (GRA)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-25219*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MATERIALS AND PROCESSES FOR SHUTTLE ENGINE, EXTERNAL TANK, AND SOLID ROCKET BOOSTER
R. J. Schwinghamer Jun. 1977 52 p refs
(NASA-TN-D-8511; M-223) Avail: NTIS HC A04/MF A01 CSCL 21H

The Shuttle flight system is composed of the Orbiter, an External Tank (ET) that contains the ascent propellant to be used by the Space Shuttle Main Engines (SSME), and two Solid Rocket Boosters (SRB). The ET is expended on each launch; the Orbiter and SRB's are reusable. It is the requirement for reuse which poses the exciting new materials and processes challenges in the development of the Space Shuttle. A brief description of the Space Shuttle and the mission profile is given. The Shuttle configuration is then described with emphasis on the SSME, ET, and SRB. The materials selection, tracking, and control system used to assure reliability and to minimize cost are described, and salient features and challenges in materials and processes associated with the SSME, ET, and SRB are subsequently discussed. Author

N77-25220# Engins Matra, Velizy (France).
PROTOTYPE DIGITAL ELECTRONICS FOR PROCESSING TACHOMETRIC INFORMATION [ETUDE ET REALISATION D'UN PROTOTYPE D'ELECTRONIQUE DIGITALE DE TRAITEMENT D'INFORMATIONS TACHYMETRIQUES]
Desmons and Devilliers 1976 91 p refs In FRENCH
(N-30-471-0) Avail: NTIS HC A05/MF A01

An inertia wheel system for three-axis stabilization of geostationary satellites and its associated digital electronics is discussed. A theoretical study is presented on the realization of a rotating mobile kinetic moment in a plane based on two kinetic moments produced by inertia wheels rotating in one direction (wheels in V configuration). The constraints on defining a system for processing the associated tachometric information are analyzed. A solution is given, and a breadboard logic circuit was realized. ESA

N77-25221# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany). Inst. fuer Flugtreib- und Schmierstoffe.
HELIOS A SOLAR PROBE - ANTENNA DESPIN DRIVE MECHANISM. BEARING CHARACTERISTICS IN THERMAL VACUUM AND DURING MISSION
Werner Kullmann, Eilhard Jantzen, and Willy Hellwig 31 Dec. 1976 28 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-400)
(DLR-FB-76-70) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, DM 15.10

Tests were carried out with the antenna despin mechanism of the Helios solar probe to determine the effects of temperature gradients of bearings on the friction and restart characteristics. In addition, mission data of the despin mechanism of Helios A with respect to bearing temperature and friction over the complete mission time of 18 months were evaluated and discussed. Author (ESA)

N77-25222# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PHOTOMETRIC REDUCTIONS: THEORY AND PRACTICE
Laurence G. Taff 17 Dec. 1976 33 p refs
(Contract F19628-76-C-0002; AF Proj. 2128)
(AD-A035870; TN-1976-35; ESD-TR-76-343) Avail: NTIS HC A03/MF A01 CSCL 20/6

This report discusses sundry topics in the theory and practice of the reduction of photometric data. The topics included are monochromatic extinction, wide-band extinction with all second-order terms, transformations from the instrumental system to the standard system, error analysis, and observing procedures. In addition, the approximate computation of an artificial satellite's standard magnitude from extremely wide-band data is discussed. Author (GRA)

N77-25223# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE HANDLING AND USES OF THE SAO CATALOG
Laurence G. Taff 5 Nov. 1976 21 p refs
(Contract F19628-76-C-0002)
(AD-A035871; EST-6; ESD-TR-76-318) Avail: NTIS HC A02/MF A01 CSCL 22/2

The complete and rigorous update procedures applied to the 195.0 epoch SAO Catalog are described. The corrections included are the terms of elliptic aberration, precession, proper motion, and foreshortening e.g., parallax and radial velocity terms. The uses of the updated catalog are schematically described for the local reduction of artificial satellite positions. Finally, an annotated FORTRAN program is included. Author (GRA)

N77-25224# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Propulsion Directorate.
STINGER LAUNCH AND FLIGHT MOTOR CASE EVALUATION
J. W. Wright Sep. 1976 57 p
(DA Proj. 1X2-64306-D-646)
(AD-A035944; RK-7T-3) Avail: NTIS HC A04/MF A01 CSCL 21/8

An investigation was initiated to evaluate the acceptability of STINGER launch and flight motor cases. These efforts consisted of evaluating the mechanical properties of the 300 grade maraging steel launch and flight case material by tensile tests and evaluating the strength of the launch and flight cases by hydroburst and the launch cases by dynamic burst. The dynamic burst pressure for the launch motor cases with 0.127-mm (0.005-in.) radius keys was 5.25 MPa (762 PSI) higher than the standard hydroburst pressure of 54.248 MPa (7868 PSI), an increase of 10 %. The STINGER launch motor system reliability at the expected operating conditions is thereby increased significantly because the design was based on standard hydroburst strength. The results for the flight motor cases tested in this program reflected problems with the thread design of the forward joint although the results from one test and others from Atlantic Research Corporation indicate that the burst pressure is certainly well above require-

ments. The strength of the flight motor case could be reduced significantly and, in fact, should be if possible because of the potential of failure due to marginal fracture toughness capability. An undetected flaw or especially one introduced after the proof test during the service life could result in catastrophic failure.
GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N77-25225*# Martin Marietta Aerospace, Denver, Colo.
ORBITER/PAYLOAD CONTAMINATION CONTROL ASSESSMENT SUPPORT Final Report
R. O. Rantanen and D. A. StrangeJensen 29 Apr. 1977 134 p refs
(Contract NAS9-14767)
(NASA-CR-151365; MCR-77-107) Avail: NTIS HC A07/MF A01 CSCL 22A

The development and use of a contamination math model of the shuttle orbiter which incorporates specific shuttle orbiter configurations and contamination sources is described. These configurations and sources represent the latest design of the shuttle orbiter and its sources. The results of model predictions for many lines-of-sight and individual and grouped sources are presented. Support trade studies primarily concerned with the supplemental flash evaporator location and operation are presented.
Author

N77-25226*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
HIGH PRESSURE GAS STORAGE SYSTEM CONSUMABLE ANALYSES FOR ALT FLIGHTS FREE FLIGHT 1 AND FREE FLIGHT 6
James E. Hurst Apr. 1977 30 p refs
(Contract NAS9-15200)
(NASA-CR-151417; LEC-10442) Avail: NTIS HC A03/MF A01 CSCL 22A

Consumables analyses are presented for the high pressure gas storage oxygen (O2), and hydrogen (H2) reactant systems for orbiter vehicle 101 approach and landing tests, for two flights, free flight 1 and free flight 6 are given. The consumables analyses are based on average power data. The required system and mission data updates were made in order to perform the analyses, notably the thermal environment profiles of the reactant storage cylinders and the power profile for the Electrical power subsystem. No mission-dependent environment profiles were provided; therefore, nominal free flight mission profile was used to generate environment profiles for free flights 1 and 6.
Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N77-25227*# Business and Technological Systems, Inc., Seabrook, Md.
AN ANALYSIS OF SATELLITE STATE VECTOR OBSERVABILITY USING SST TRACKING DATA Final Report
Thomas S. Englar, Jr. and Carol L. Hammond Jul. 1976 67 p
(Contract NAS5-20830)
(NASA-CR-152527; BTS-TR-76-30) Avail: NTIS HC A04/MF A01 CSCL 22A

Observability of satellite state vectors, using only SST tracking data was investigated by covariance analysis under a variety of satellite and station configurations. These results indicate very precarious observability in most short arc cases. The consequences of this are large variances on many state components, such as the downrange component of the relay satellite position. To illustrate the impact of observability problems, an example is given of two distinct satellite orbit pairs generating essentially the same data arc. The physical bases for unobservability are outlined and related to proposed TDRSS configurations. Results are relevant to any mission depending upon TDRSS to determine satellite state. The required mathematical analysis and the software used is described.
Author

N77-25228# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
SATELLITE GEODESY REFERENCE SYSTEMS Ph.D. Thesis - Tech. Univ., Munich [DIE BEZUGSSYSTEME DER SATELLITENGEODAESIE]
Erich Nagel Bayerische Akad. der Wiss. 1976 140 p refs In GERMAN
(Ser-C/Diss-223; TUM-MITT-136; ISBN-3-7696-9279-9) Avail: NTIS HC A07/MF A01

In satellite geodesy, terrestrial and extraterrestrial reference frames are needed. Both groups of reference frames were investigated in detail. Possible realizations of the reference frame on which the Newton-Euler equation of motion is based and the usefulness of those realizations for satellite geodesy are discussed. Possibilities of definition and realization of terrestrial reference frames and their usefulness were investigated. In particular, the difficulties are shown which arise in realizing a reference frame for the development of the earth's gravitational potential in spherical harmonics adequate to current achievable observation accuracies. The terrestrial and extraterrestrial reference frames suitable for practical use are discussed and the coordinate-transformations between the systems are given. Effects of errors in the transformation parameters and from simplifications in the formulas on the accuracy of transformation are examined.
Author (ESA)

N77-25229# PRC Information Sciences Co., Rome, N.Y.
SPACE SURVEILLANCE SOFTWARE SUPPORT. VOLUME 1, PART 1, BOOK 1: PROJECT SUMMARY AND COMPUTER PROGRAM DOCUMENTATION Final Technical Report, Apr. 1975 - Jun. 1976
P. Richard Conti RADC Oct. 1976 241 p refs 6 Vol.
(Contract F30602-75-C-0167; AF Proj. 6512)
(AD-A033657; RADC-TR-76-261-Vol-1-Pt-1-Bk-1) Avail: NTIS HC A11/MF A01 CSCL 15/3

The objective of this effort was to modify the RADC trajectory program orbit program and various radar cross section programs were modified to run on the RADC HIS 6180 computer under the GCOS system software. The RADC trajectory program was modified to include the capability of processing multiple (20) radar sites and multiple (20) targets in the program so that various radar parameters could be determined. This type of information is essential in performing radar coverage analyses for systems such as COBRA TALON, SEEK SAIL, COBRA DANE and COBRA JUDY. This portion of the effort is documented in Vol 1. Vol 2 documents a procedure for punching cards in ASCII format and reading the data onto a HP cassett for subsequent plotting with an HP 9820 calculator system. Vol 3 documents some Radar Signature and Radar Scattering computer programs. A three dimensional plot program contained in this volume has been incorporated into the Interactive Radar Simulator for plotting three dimensional antenna patterns and cross section aspect angle histories.
Author (GRA)

N77-25230# Rome Air Development Center, Griffiss AFB, N.Y.
SPACE SURVEILLANCE SOFTWARE SUPPORT. VOLUME 1, PART 2: RADC TRAJECTORY PROGRAM NUMERICAL/ANALYTIC DATA Final Report
George A. Ellis Oct. 1976 98 p refs
(AF Proj. 6512)
(AD-A033712; RADC-TR-76-261-Vol-1-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 15/3

A numerical and analytical data base is presented for the missile/space vehicle mission analyst. Operational constraints considered were launch site locations, orbital transfer maneuvers, and missile turnout parameters.
GRA

N77-25231# Rome Air Development Center, Griffiss AFB, N.Y.
SPACE SURVEILLANCE SOFTWARE SUPPORT. VOLUME 2: GENERALIZED DATA ENTRY AND PLOT PROGRAM Final Report, Jan. 1975 - Jun. 1976
John A. Manley Oct. 1976 118 p
(AF Proj. 6512)
(AD-A033711; RADC-TR-76-261-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 15/3

The primary purpose of this report is to document the Hewlett-Packard (HP) 9820A calculator programs used to plot data generated by the HIS-6280 digital computing system. This was done because on-line plotting at the central computer is impossible and large volumes of data connot be digested efficiently by the engineers concerned. Quickly plotted data often allows an engineer to narrow down the number of computer runs by bounding a specific problem since a picture is worth a thousand words. For example, trajectory curves (an antenna pattern of waveform response to a target) are more than long tables of numerical listings. The objective of the plotting capability outlined in this report is to free the engineer for more analysis work and cut the required number of computer runs by bounding the problems in a timely manner. This will result in more effective use of the engineer at a cost savings to the Air Force. In addition, this report will serve as a supplement to the HP manuals detailing the use of the HP paper tape and punched card readers.
Author (GRA)

N77-25232# PRC Information Sciences Co., Rome, N.Y.
SPACE SURVEILLANCE SOFTWARE SUPPORT. VOLUME 3: RADAR SIGNATURE AND RADAR SCATTERING PRINCIPLES INVESTIGATION SOFTWARE Final Technical Report, Apr. 1975 - Jul. 1976
P. Richard Conti RADC Oct. 1976 280 p 6 Vol.
(Contract F30602-75-C-0167; AF Proj. 6512)
(AD-A033709; RADC-TR-76-261-Vol-3) Avail: NTIS HC A13/MF A01 CSCL 15/3
For abstract, see N77-25229.

N77-25233# PRC Information Sciences Co., Rome, N.Y.
SPACE SURVEILLANCE SOFTWARE SUPPORT. VOLUME 1, PART 1, BOOK 2: COMPUTER PROGRAM DOCUMENTATION Final Report, Apr. 1975 - Jul. 1976
P. Richard Conti Griffiss AFB, N. Y. RADC Oct. 1976 438 p
(Contract F30602-75-C-0167)
(AD-A033514; RADC-TR-76-261-Vol-1-Pt-1-Bk-2) Avail: NTIS HC A19/MF A01 CSCL 15/3
For abstract, see N77-25229.

N77-25234# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF EXTENDED KALMAN FILTER TO AN ADVANCED FIRE CONTROL SYSTEM M.S. Thesis
Robert N. Lutter Dec. 1976 247 p refs
(AD-A035293; GE/EE/76-31) Avail: NTIS HC A11/MF A01 CSCL 19/5

An extended Kalman Filter is developed to aid the tracking of an air-to-air missile from a maneuvering target aircraft. The filter exploits knowledge of the dominant dynamic effects acting on a missile that is nonthrusting and utilizing a proportional navigation guidance scheme, i.e. accelerations due to aerodynamic forces. It is designed to provide both dynamic tracking estimates in a local inertial frame and estimates of the proportional navigation constant and another pertinent parameter. A feasibility analysis of the filter is conducted. Its performance is compared to a more conventional filter that utilizes a first order GAUSS-Markov random process acceleration model. In addition, an evaluation is made of the filter's capability to recover from large initial errors in state estimates. GRA

N77-25235# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
TIME STANDARD SYSTEM FOR DIRECTING SATELLITE TRACKING ANTENNAS Final Technical Report, May - Dec. 1975
C. S. Wilson and J. L. Grover Wright-Patterson AFB, Ohio AFAL Nov. 1976 56 p
(Contract F33615-75-C1222; AF Proj. 1227)
(AD-A034983; AFAL-TR-76-145) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report presents the results of a program directed to the implementation of a time standard system to be used with a PDP-11/45 digital controller for the purpose of directing a ground-based satellite tracking antenna. The function of the time standard system is to present, on command, absolute time-of-day information to the PDP-11/45 which is subsequently used in conjunction with memory-stored, satellite orbital parameter data to generate antenna steering signals. To ensure the required antenna pointing accuracy, the absolute time information must be correct to within 100 milliseconds of the primary standard maintained by the National Bureau of Standards (NBS). The time standard system consists primarily of (1) a WWVB receiver and associated antenna for reception of the time-coded radio transmission from the NBS station at Fort Collins, Colorado, and (2) a time code generator which accepts the amplified WWVB signal and then presents the time information in the form of both a front panel numerical readout and in a digital format suitable for use by the PDP-11/45 digital controller. The time standard system also included the capability of being interfaced with a Georgia Tech owned HP-2100 data acquisition system.
GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-25236*# McDonnell-Douglas Corp., St. Louis, Mo.
SPACE SHUTTLE ENGINEERING AND OPERATIONS SUPPORT. AVIONICS SYSTEM ENGINEERING
P. A. Broome, R. J. Neubaur, and R. T. Welsh 20 May 1976 62 p refs
(Contract NAS9-14960)
(NASA-CR-151364; Rept-1.3-DN-C0712-003) Avail: NTIS HC A04/MF A01 CSCL 22A

The shuttle avionics integration laboratory (SAIL) requirements for supporting the Spacelab/orbiter avionics verification process are defined. The principal topics are a Spacelab avionics hardware assessment, test operations center/electronic systems test laboratory (TOC/ESL) data processing requirements definition, SAIL (Building 16) payload accommodations study, and projected funding and test scheduling. Because of the complex nature of the Spacelab/orbiter computer systems, the PCM data link, and the high rate digital data system hardware/software relationships, early avionics interface verification is required. The SAIL is a prime candidate test location to accomplish this early avionics verification. Author

N77-25237# European Space Research and Technology Center, Noordwijk (Netherlands). Structures and Thermal Control Div.
GUIDELINES FOR THE STRUCTURAL DESIGN OF UNMANNED SPACECRAFT
Paris ESA 1 Feb. 1977 16 p
(ESA-PSS-29-Issue-1) Avail: NTIS HC A02/MF A01

The essential design, development, and testing requirements for an unmanned spacecraft structure are outlined. Spacecraft placed in orbit from manned vehicles are excluded. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N77-25238*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
HEAT CAPACITY MAPPING RADIOMETER FOR AEM SPACECRAFT Final Engineering Report, Jul. 1975 - Mar. 1977
G. E. Sonnek Mar. 1977 162 p
(Contract NAS5-20621)
(NASA-CR-152529) Avail: NTIS HC A08/MF A01 CSCL 14B

The operation, maintenance, and integration of the applications explorer mission heat capacity mapping radiometer is illustrated in block diagrams and detail schematics of circuit functions. Data format and logic timing diagrams are included along with radiometric and electronic calibration data. Mechanical and electrical configuration is presented to provide interface details for integration of the HCMR instrument to AEM spacecraft.
Author

N77-25239# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
FAR UV OBSERVATIONS USING THE FAUST INSTRUMENT ON THE SPACE SHUTTLE ORBITAL FLIGHT TEST MISSIONS
Georges Courtes, Principal Investigator, Jean-Michel Deharveng, Michel Laget, Stuart Bowyer (Calif. Univ., Berkeley), and Roger Malina (Calif. Univ., Berkeley) 10 Nov. 1976 54 p refs
(LAS-DRT-OFT-01-76) Avail: NTIS HC A04/MF A01

The FAUST (Far Ultraviolet Space Telescope) telescope to be flown as a special purpose instrument on the space shuttle orbital flight test missions is described. This instrument, a compact far UV photographic telescope composed of a Wynne camera and a microchannel plate image intensifier with photographic readout, will observe extended or point sources of far UV (1,100 to 3,500 A) radiation inaccessible to observers on earth. Both broadband imaging and low resolution spectroscopy will be performed in a large field (7.5 deg). The wide field of view and the high sensitivity of the instrument will allow an evaluation of the shuttle environment and assess the far UV radiation background contamination. The shuttle interfaces are described. Data analysis including ground and in-flight calibrations as well as data reduction means are presented. The development plan necessary for adaption of the instrument for utilization on shuttle OFT missions is summarized.
ESA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N77-25240*# Vought Corp., Dallas, Tex.
ROCKET PROPULSION HAZARD SUMMARY: SAFETY CLASSIFICATION, HANDLING EXPERIENCE AND APPLICATION TO SPACE SHUTTLE PAYLOAD
D. F. Pennington, T. Man, and B. Persons May 1977 213 p refs
(Contract NAS1-12500; NASA Order R-150)
(NASA-CR-145185) Avail: NTIS HC A10/MF A01 CSCL 21H

The DOT classification for transportation, the military classification for quantity distance, and hazard compatibility grouping used to regulate the transportation and storage of explosives are presented along with a discussion of tests used in determining sensitivity of propellants to an impact/shock environment in the absence of a large explosive donor. The safety procedures and requirements of a Scout launch vehicle, Western and Eastern Test Range, and the Minuteman, Delta, and Poseidon programs are reviewed and summarized. Requirements of the space transportation system safety program include safety reviews from the subsystem level to the completed payload. The Scout safety procedures will satisfy a portion of these requirements but additional procedures need to be implemented to comply with the safety requirements for Shuttle operation from the Eastern Test Range.
Author

N77-25241*# Hughes Research Labs., Malibu, Calif. Ion Physics Dept.
FABRICATION AND VERIFICATION TESTING OF ETM 30 cm DIAMETER ION THRUSTERS Final Report, 14 Mar. 1974 - 15 Sep. 1976
C. Collett Apr. 1977 284 p refs
(Contract NAS3-17803)
(NASA-CR-135193) Avail: NTIS HC A13/MF A01 CSCL 21C

Engineering model designs and acceptance tests are described for the 800 and 900 series 30 cm electron bombardment thrustors. Modifications to the test console for a 1000 hr verification test were made. The 10,000 hr endurance test of the S/N 701 thruster is described, and post test analysis results are included.
Author

N77-25242*# ARO, Inc., Arnold Air Force Station, Tenn.
VIBRATION TESTING OF THE JE-M-604-4-IUE ROCKET MOTOR (THIOKOL P/N E 28639-03) Final Report
R. E. Alt and J. T. Tosh AEDC Dec. 1976 293 p Prepared for NASA Goddard Space Flight Center, Greenbelt, Md.
(NASA-CR-153224; AEDC-TR-76-172; AD-A034227; ARO-VKF-TR-76-65) Avail: NTIS HC A13/MF A01 CSCL 21/8

The NASA International Ultraviolet Explorer (IUE) rocket motor (TE-M-604-4), a solid fuel, spherical rocket motor, was vibration tested in the Impact, Vibration, and Acceleration (IVA) Test Unit of the von Karman Gas Dynamics Facility (VKF). The objective of the test program was to subject the motor to qualification levels of sinusoidal and random vibration prior to the altitude firing of the motor in the Propulsion Development Test Cell (T-3), Engine Test Facility (ETF), AEDC. The vibration testing consisted of a low level sine survey from 5 to 2,000 Hz, followed by a qualification level sine sweep and qualification level random vibration. A second low level sine survey followed the qualification level testing. This sequence of testing was accomplished in each of three orthogonal axes. No motor problems were observed due to the imposition of these dynamic environments.
Author (GRA)

N77-25243# ECON, Inc., Princeton, N.J.
A BENEFIT-COST ANALYSIS OF NUCLEAR POWER APPLIED TO THE GPS MISSION
Joel S. Greenberg 13 Apr. 1977 41 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Energy in Sep.-Oct. 1977 Sponsored by ERDA
Avail: NTIS HC A03/MF A01

Solar powered spacecraft are currently being developed for the Global Positioning System (GPS). An analysis was performed of the economic benefits which may result from developing and utilizing nuclear powered spacecraft in place of solar powered spacecraft for the GPS mission. The analysis considers cost uncertainties, launch system and spacecraft subsystem reliability, time phasing of nuclear spacecraft into a system consisting of solar powered spacecraft, a nuclear demonstration experiment, and the likelihood of nuclear operational spacecraft implementation in terms of the successful duration of the experiment, single, and multiple payload launches. The probability distributions of all pertinent events, annual costs, and present value of costs and benefits are developed.
Author

N77-25244*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF THERMAL ANALYTIC MODEL WITH EXPERIMENTAL TEST RESULTS FOR 30-SENTIMETER-DIAMETER ENGINEERING MODEL MERCURY ION THRUSTER
Jon C. Oglebay Washington Jun. 1977 33 p refs
(NASA-TM-X-3541; E-9064) Avail: NTIS HC A03/MF A01 CSCL 21C

A thermal analytic model for a 30-cm engineering model mercury-ion thruster was developed and calibrated using the experimental test results of tests of a pre-engineering model 30-cm thruster. A series of tests, performed later, simulated a wide range of thermal environments on an operating 30-cm

engineering model thruster, which was instrumented to measure the temperature distribution within it. The modified analytic model is described and analytic and experimental results compared for various operating conditions. Based on the comparisons, it is concluded that the analytic model can be used as a preliminary design tool to predict thruster steady-state temperature distributions for stage and mission studies and to define the thermal interface bewteen the thruster and other elements of a spacecraft. Author

N77-25245# Lockheed Missiles and Space Co., Palo Alto, Calif.
THEORY OF OSCILLATIONS EXCITED BY COMBUSTION INSTABILITY IN ROCKET MOTORS
S. K. Aslanov [1976] 5 p refs Transl. into ENGLISH from Dopov. Akad. Nauk Ukr RSR, Ser. A (USSR), no. 10, 1976 p 892-895
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The small perturbation theory is used to mathematically model the excitation of longitudinal oscillations in the combustion chamber of a jet engine. The existence of different combustion modes with two bands of growing oscillations (high and low frequency) is described by a single analytical method. Author

N77-25246# European Space Agency, Paris (France).
THEORY OF THE HIGH-TEMPERATURE, HOLLOW CATHODE, A MODEL OF THE CATHODE MECHANISM
Harro Bessling May 1977 63 p refs Transl. into ENGLISH of 'Theorie der Hochtemperatur-Hohlkathode, ein Modell fuer den Kathodenmechanismus', DFVLR, Stuttgart Report DLR-FB-76-50, 22 Sep. 1976 Original report in GERMAN previously announced as N77-21192 Original German report available from DFVLR, Cologne DM 21.50
(ESA-TT-377; DLR-FB-76-50) Avail: NTIS HC A04/MF A01

The hollow cathode in the discharge chamber of the electrostatic Kaufman thruster differs from the conventional hollow cathodes in allowing essentially higher operational temperatures, extremely small geometric measurements, higher discharge currents, and considerably lower discharge potential. In order to be able to design this cathode with regard to a required long life time and a good generating efficiency of electrons, the mechanism of cathode must be known. Using experimental results, a function model for a high temperature hollow cathode without additional low work function material was developed, from which a quantitative relationship between the operational data was derived. The theoretical values are compared with the measurement values in the test plant. Author (ESA)

N77-25247# Aerotherm Corp., Mountain View, Calif. Aerotherm Div.
AFRPL GRAPHITE PERFORMANCE PREDICTION PROGRAM. IMPROVED CAPABILITY FOR THE DESIGN AND ABLATION PERFORMANCE PREDICTION OF ADVANCED AIR FORCE PROPELLANT ROCKET NOZZLES Final Report, 1 May 1974 - 31 Jul. 1976
H. Tong, G. J. Hartman, E. K. Chu, and A. V. Murphy Dec. 1976 255 p refs
(Contract F04611-74-C-0023)
(AD-A035575; Aerotherm-TR-76-16(7113); AFRPL-TR-76-70) Avail: NTIS HC A12/MF A01 CSCL 21/8

A combined experimental and analytic program was conducted to develop improved procedures for predicting the ablation performance of graphite materials in rocket nozzles. Particular emphasis was placed on conditions representative of the throat region of an MX nozzle design which would use graphite materials that are representative of the current state of materials development. New kinetic response correlation functions were developed for G-90 and ATJ bulk graphites, 15% silicon carbide modified pyrolytic graphites, c plane pyrolytic graphite, and Pyrocarb 901 carbon-carbon. These functions were included into the Aerotherm GASKET code along with several modifications to improve on thermochemical modeling accuracy. This modified code, GASKET 2, includes a number of new chemical species, improved generalized input requirements, and kinetically controlled carbon sublimation models. The GASKET 2 code was used in a number of performance studies to predict the performance of a number of rocket nozzles to be tested in other Air Force programs. The rocket nozzle ablation performance prediction procedures for several rocket motor fabricators were mutually compared to determine the probable ranges of predicted variables. These ranges were used in an ablation rate sensitivity study to define the most critical parameters. The mass transfer coefficient and the kinetic rate constants were shown to be the most critical parameters to be accurately known. Author (GRA)

N77-25248# California Univ., Berkeley. Dept. of Mechanical Engineering.
NONEQUILIBRIUM EFFECTS IN NOZZLES AND EXHAUST PLUMES Final Report, 1 Jun. 1973 - 29 Jun. 1976
Melvyn C. Branch Sep. 1976 35 p refs
(Grant AF-AFOSR-2560-73; AF Proj. 9711)
(AD-A035396; ME-76-12; AFOSR-77-0038TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Results of a study of nonequilibrium effects in jet and rocket nozzles and exhaust plumes are presented. The study considered turbulence modeling of axisymmetric compressible jets, particle laden jets and chemical nonequilibrium in axisymmetric jets. It was found that available turbulence models do not correlate a wide range of data for compressible jets. Studies of particle laden jets provided reasonable correlation to experimental data. The chemical nonequilibrium studies suggest a possible explanation for difference between observed and previously predicted radiation behavior of axisymmetric exhaust plumes.
Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N77-25249*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION-BEAM TECHNOLOGY AND APPLICATIONS
Wayne R. Hudson, Ronald R. Robson, and James S. Sovey Washington May 1977 37 p refs
(NASA-TM-X-3517; E-8910) Avail: NTIS HC A03/MF A01 CSCL 20L

Ion propulsion research and development yields a mature technology that is transferable to a wide range of nonpropulsive applications, including terrestrial and space manufacturing. A xenon ion source was used for an investigation into potential ion-beam applications. The results of cathode tests and discharge-chamber experiments are presented. A series of experiments encompassing a wide range of potential applications is discussed. Two types of processes, sputter deposition, and erosion were studied. Some of the potential applications are thin-film Teflon capacitor fabrication, lubrication applications, ion-beam cleaning and polishing, and surface texturing. Author

N77-25250# Fluorochem, Inc., Azusa, Calif.
HIGH ENERGY HALOGEN CHEMISTRY Annual Report, 1 Dec. 1975 - 30 Nov. 1976
Kurt Baum, Jerold S. Horn, and Duane A. Lerdal Jan. 1977 53 p refs
(Contract N00014-71-C-0176)
(AD-A035349) Avail: NTIS HC A04/MF A01 CSCL 07/3

The compound (3-Fluoro-3,3-dinitropropyl) methyldiphenysilane was prepared from (3-bromopropyl) methyldiphenylsilane by sodium nitrite displacement, oxidative nitration and fluorination. Reaction with bromine gave (3-fluoro-3, 3-dinitropropyl)methyldibromosilane. The dibromide was hydrolyzed under a variety of conditions to give cyclic polysiloxanes. The dibromide or the polysiloxanes reacted with HF to give (3-fluoro-3,3-dinitropropyl)methyldifluorosilane, which was hydrolyzed readily by base but was relatively stable to aqueous acid. Polymerization of the cyclic polysiloxanes was studied. By a synthesis sequence similar to that above, bis-2(3-fluoro-3,3-dinitropropyldiphenylsilane was prepared. Brominative dephenylation and hydrolysis gave the cyclic trisiloxane. The reaction of fluorodinitroethanol with poly(dichlorophosphazine) in pyridine gave replacement of chlorines by fluorodinitroethoxy groups, but considerable amounts of pyridine were also incorporated into the polymer. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N77-25251*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A STUDY OF DAMAGE ZONES OR CHARACTERISTIC LENGTHS AS RELATED TO THE FRACTURE BEHAVIOR OF GRAPHITE/EPOXY LAMINATES Interim Report, 1 Oct. 1976 - 30 Sep. 1977
Y. T. Yeow and H. F. Brinson May 1977 40 p refs
(Grant NsG-2038)
(NASA-CR-153214; VPI-E-77-15) Avail: NTIS HC A03/MF A01 CSCL 11D

Uniaxial tensile tests conducted on a variety of graphite/epoxy laminates, containing narrow rectangular slits, square or circular holes with various aspect ratios are discussed. The techniques used to study stable crack or damage zone growth--namely, birefringence coatings, COD gages, and microscopic observations are discussed. Initial and final fracture modes are discussed as well as the effect of notch size and shape, and laminate type on the fracture process. Characteristic lengths are calculated and compared to each other using the point, average and inherent flaw theories. Fracture toughnesses are calculated by the same theories and compared to a boundary integral equation technique. Finite width K-calibration factors are also discussed.
Author

N77-25252# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
TENSILE FAILURE OF UNIDIRECTIONAL COMPOSITE MATERIALS
W. G. J. Thart, F. A. Jacobs, and J. H. Nassette 16 Jul. 1975 68 p refs
(Contract NIVR-1744)
(NLR-TR-75114-U) Avail: NTIS HC A04/MF A01

Theoretical strength predictions for unidirectional composite materials under tensile loading were considered. Tensile tests on carbon/epoxy and boron/epoxy specimens were performed in order to compare the experimental strength data with the theoretical strength predictions, based on fiber strength distributions. It was concluded that for the tested carbon/epoxy specimens, the best fit was attained by the rule of mixtures. For boron/epoxy specimens, the bundle strength theory gave the best approximation. Use of the more refined strength predictions is not recommended as long as composites are fabricated with voids and non-uniformly distributed fibers.
Author (ESA)

N77-25253# Aeronautical Research Inst. of Sweden, Stockholm.
NON-LINEAR STRAIN RESPONSE OF FIBRE REINFORCED PLASTIC LAMINATES, PART 1
Peter Stehlin Aug. 1974 34 p refs 2 Vol.
(FFA-HU-1716-Pt-1) Avail: NTIS HC A03/MF A01

The nonlinear response of laminated composites built up of unidirectional plies is discussed. A comparative study of different hypotheses relating to strength and nonlinear strain response of filter reinforced plastic laminates was performed. Theory was extended to cover both loading and unloading of laminates. Post-failure behavior of the lamina was treated using a simple statistical model. A computer program was presented for calculating the strain response of arbitrary laminates according to any one of five different deformation and failure models. The use of the program is described in part 2 of this report. As an application, the strength of various carbon fiber reinforced laminates was evaluated with the purpose of pin-pointing experiments suitable for discriminative testing. Results indicate that such tests should be performed either in compression or using load systems, which include a compressive component.
Author (ESA)

N77-25254# Aeronautical Research Inst. of Sweden, Stockholm.
NON-LINEAR STRAIN RESPONSE OF FIBER REINFORCED PLASTIC LAMINATES, PART 2
Peter Stehlin Aug. 1974 31 p refs 2 Vol.
(FFA-HU-1716-Pt-2) Avail: NTIS HC A03/MF A01

A computer program for calculating the nonlinear strain response of a fiber reinforced plastic laminate consisting of M orthotropic layers of arbitrary properties and orientation is described. The use of the program is explained. An example is discussed applied to computation of the stress-strain curve of a carbon fiber reinforced plastic laminate having three layers arranged at plus or minus 60 and 90 deg.
ESA

N77-25255# Acurex Corp., Mountain View, Calif. Aerotherm Div.
AEROTHERM GRAPHITE SURFACE KINETICS COMPUTER PROGRAM (GASKET2) USER'S MANUAL Progress Report, 1 May 1974 - 31 Jul. 1976
E. K. Chu and H. Tong Dec. 1976 175 p refs
(Contract F04611-74-C-0023; AF Proj. 3059)
(AD-A036129; Aerotherm-TR-76-13(7113); AFRPL-TR-76-92)
Avail: NTIS HC A08/MF A01 CSCL 11/4

The Aerotherm GASKET code was modified. The modified code, entitled GASKET2, includes a generalized computational scheme for combined equilibrium-nonequilibrium systems, sublimation kinetics, and an expanded thermochemistry data bank including the Duff-Bauer hydrocarbon species. GASKET2 predicts higher ablation rates than GASKET at surface temperatures above 5500 R. Both codes predict virtually equal rates at surface temperatures below 5500 R. GASKET2 also accepts an increased number of surface kinetics controlled reactions. In addition to the modifications, surface kinetics for ATJ and G-90 bulk graphites, 15% silicon carbide modified pyrolytic graphite and pyrocarb 901 and Carbitex 700 carbon/carbon materials were added to GASKET2. Also, improved surface kinetics for C plane pyrolytic graphite were included.
Author (GRA)

N77-25256# Goldsworthy Engineering, Inc., Torrance, Calif.
MM AND T-PULTRUDED COMPOSITE STRUCTURAL ELEMENTS Final Report
Brian H. Jones and William Jakway Dec. 1976 124 p refs
(Contract DAAJ02-74-C-0053)
(AD-A035217; USAAMRDL-TR-76-5) Avail: NTIS HC A06/MF A01 CSCL 11/4

The objectives of this program were to establish the manufacturing technology base in order to pultrude with a range of resin matrices and reinforcing forms, to investigate the post-forming capability of epoxy matrix pultrusions, and to derive a representative range of static and fatigue mechanical property design allowables. Additionally, structural efficiency studies were performed to evaluate the potential advantages of using pultruded substructural elements. It was concluded that even using existing epoxy system, pultrusion is a highly viable process that results in structures possessing good mechanical properties at potentially low cost. Post-forming operations may be readily carried out, which further enhances the potential application areas for the technique.
Author (GRA)

N77-25257# Florida Univ., Gainesville.
STUDIES ON THE PENETRATION MECHANICS OF COMPOSITE PLATES Final Report, Jan. 1973 - Dec. 1976
R. L. Sierakowski, C. A. Ross, L. E. Malvern, and N. Cristescu Dec. 1976 48 p refs
(Contract DAAG29-76-G-0085)
(AD-A035611; ARO-11946.5-E) Avail: NTIS HC A03/MF A01 CSCL 11/4

Experimental studies have been conducted on a large number of orthotropic composite plates of 0 degrees - 90 degrees fiber orientation subjected to kinetic energy impactors and blast type loadings. The fiberglass-epoxy composites were tested at loading below that required to cause penetration or complete failure. A systematic study of the resultant failure patterns is reported on and a proposed model for explaining the observed plate failure presented. Some quantitative measures of plate performance under dynamic loads are indicated.
Author (GRA)

N77-25258# Tennessee Univ. Space Inst., Tullahoma. Dept. of Metallurgical Engineering.
INVESTIGATIONS INTO THE MECHANISMS OF THERMAL CYCLING DAMAGE IN METAL MATRIX COMPOSITES Technical Report, 1 Jul. 1975 - 30 Jun. 1976
Marvis K. White and Maurice A. Wright Dec. 1976 90 p refs
(Contract N00014-75-C-0352)

(AD-A035179; Met-E-761) Avail: NTIS HC A05/MF A01 CSCL 11/6

The mechanical properties of 6061, 2024, and 1100 aluminum reinforced with boron fibers were measured after 6000 thermal cycles in argon and in air between ambient temperature and 425 C. The cycle periods used were 6 and 12 minutes in argon and 12 minutes in air. Fiber strengths were also measured before and after cycling. In addition, thermal cycling tests were conducted on carbon-aluminum composites. GRA

N77-25259# Naval Surface Weapons Center, Dahlgren, Va.
SHOCK WAVE COMPRESSION OF AN ALUMINA-FILLED EPOXY Final Report
W. Mock, Jr. and W. H. Holt Dec. 1976 20 p refs
(AD-A035090; NSWC/DL-TR-3530) Avail: NTIS HC A03/MF A01 CSCL 11/4

The shock wave equation of state for an alumina-filled epoxy, Castall 300, has been determined in the stress range from 0.4 to 3.7 GPa via gas gun experiments. Stress - particle velocity data was obtained by impacting Castall disks directly onto quartz gauges. Shock transit-time experiments were performed by impacting epoxy specimens surrounded by tilt pins and backed with quartz gauges. The results are compared with the shock response of an unfilled epoxy resin and an alumina-filled epoxy of different density. Author (GRA)

N77-25260# Florida Univ., Eglin AFB. Graduate Engineering Center.
DELAMINATION STUDIES OF IMPACTED COMPOSITE PLATES
C. A. Ross and R. L. Sierakowski Aug. 1976 12 p refs Repr. from the Shock and Vibration Bull., no. 46, part 3, Aug. 1976
(Grant DAAG29-76-G-0085)
(AD-A035517; ARO-11946.1-E; Bull-46) Avail: NTIS HC A02/MF A01 CSCL 11/4

Both steel-epoxy and fiberglass-epoxy composite crossplied plates were impacted with blunt ended cylindrical impactors at velocities below the critical penetration velocity. Failure mechanisms in the form of lamina delamination were observed for thirteen different types of ply arrangements. Lamina delamination was found to be the dominant failure mode and fiber breakage or pullout occurred only in the area in direct contact with the impactor. It was found for impacted fiberglass-epoxy plates that the number of plies within a given lamina, especially the first several laminae, are very important in the resulting progressive delamination. The extent of the damage appears to be related to kinetic energy imparted to the plate by the impactor. Author (GRA)

N77-25261# Boeing Aerospace Co., Seattle, Wash.
DEVELOPMENT OF A LOW-COST GRAPHITE REINFORCED COMPOSITE PRIMARY STRUCTURAL COMPONENT Final Report, May 1974 - Sep. 1976
John H. Laakso and John T. Hoggatt Dec. 1976 166 p refs
(Contract N622669-74-C-0368)
(AD-A035398; D180-18236-5) Avail: NTIS HC A08/MF A01 CSCL 10/3

In two preceeding NAVAIR programs, materials and processes studies indicated graphite reinforced polysulfone (Gr/Ps) composites have potential cost saving benefits for aircraft structure. Based on the encouraging results of the preceeding programs, the Navy funded a joint Boeing/Navy program to take the next developmental step to build and evaluate some Gr/Ps primary aircraft structural components. The Boeing portion of the program, which is summarized in this report, consisted of: Design Studies, Material and Process Studies, Structural Element and Subcomponent Testing, Prototype Component Fabrication and Delivery, Component Test Planning, Comparative Cost Analysis, Post-test Component Analysis. The prototype Gr/Ps components were designed, for demonstration purposes and low program cost, to replace the aluminum centerbody skins of the XBQM-34E Supersonic Firebee Target drone built by Teledyne Ryan Aeronautical. Comparative cost analyses were performed on preliminary designs prepared for a hypothetical large-scale aircraft fuselage panel using (1) conventional aluminum and (2) graphite-reinforced thermoplastic design concepts. A 20 percent cost saving was offered by the thermoplastic design concept in a 100-unit production run along with a 16 percent weight saving. Ground testing of the Gr/Ps components installed on a XBQM-34E airframe was performed. The components sustained the limit load condition associated with chute recovery (the critical design condition) without damage. Post-test analysis of the measured strains indicates that the load capabilities of the >Gr/Ps components exceed their ultimate load requirements. GRA

N77-25262# Delaware Univ., Newark. Center for Composite Materials.
THE EFFECTS OF RELATIVE HUMIDITY AND ELEVATED TEMPERATURE ON COMPOSITE STRUCTURES Final Report, 1 Dec. 1975 - 31 Nov. 1976
J. R. Vinson, ed., R. B. Pipes, ed., Willian J. Walker, ed., and Donald R. Ulrich, ed. Dec. 1976 515 p refs Conf. Proc. of the Workshop, Newark, 30-31 Mar. 1976
(Grant AF-AFOSR-2966-76; AF Proj. 9782)
(AD-A035437; AFOSR-77-0030TR) Avail: NTIS HC A22/MF A01 CSCL 11/4

Understanding the influence of combined relative humidity and elevated temperature on the performance of advanced polymer matrix composite structures is a matter of pacing importance to the Air Force in the development of future innovative structures. Degradation of structural strength and durability must be predictable if advanced composites are to be widely accepted as an alternate material in aerospace structural design. These transactions are the result of a Workshop, which discussed the state-of-the-art in both Polymer Chemistry and Mechanics research, dealing with the effects of relative humidity and elevated temperature on composite structures. In addition, pacing research topics were identified which must be addressed in the future if the goal of aerospace structural applications with advanced composites is to be achieved. GRA

N77-25263# Naval Postgraduate School, Monterey, Calif.
LOW ENERGY IMPACT LOADING OF GRAPHITE-EPOXY PLATES M.S. Thesis
Richard Lee Ferris Dec. 1976 106 p refs
(AD-A035890) Avail: NTIS HC A06/MF A01 CSCL 11/4

An experimental and theoretical analysis was performed on low energy impact loading of thin (.040 inches) graphite-epoxy plates. Six-inch square plates were subjected to dynamic impact (below the ballistic range) and static loading. The plate static strain energy and dynamic impact energy for failure were equal and constant. Theoretical analysis was performed using both exact and finite element methods. Small deflection theory was assumed and found to be inapplicable. The plates behaved in a manner indicating that a large deflection theoretical model would be more appropriate. Author (GRA)

N77-25264# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EFFECT OF STACKING SEQUENCE ON THE NOTCHED STRENGTH OF LAMINATED COMPOSITES Technical Report, 1 Nov. 1975 - 1 May 1976
J. M. Whitney Nov. 1976 34 p refs
(AF Proj. 7340)
(AD-A035081) Avail: NTIS HC A03/MF A01 CSCL 11/4

The effect of laminate stacking sequence on the notched and unnotched tensile strength of quasi-isotropic graphite/epoxy laminates is investigated. Notch geometry includes circular holes and center cracks. Experimental data is presented for two different stacking sequences of quasi-isotropic graphite/epoxy laminates. One stacking sequence produces large interlaminar tensile stresses along straight free-edges of a tensile coupon, while the second yields compression at the same free-edges. Three different notch sizes are used for the circular hole and center crack in conjunction with both stacking sequences. Each data point is represented by a minimum of fifteen replicates so that statistical distributions of notched and unnotched strengths can be obtained. The experimental data indicates that unnotched tensile strength is reduced by the presence of interlaminar tensile stresses at the straight free-edge, while notched strength appears to be independent of stacking sequence for notch sizes which produce tensile failure prior to delamination at the straight free-edge. Experimental results are also compared against theoretical notch strengths obtained from the average stress criterion and the point stress criterion, two recently developed

criteria for predicting notch strength of laminated composites.
GRA

N77-25265# Naval Research Lab., Washington, D. C.
HIGH PERFORMANCE COMPOSITES AND ADHESIVES FOR V/STOL AIRCRAFT Annual Report, 1 Jul. 1975 - 1 Sep. 1976
Willard D. Bascom and Luther B. Lockhart, Jr. Dec. 1976 124 p refs
(WF54593201)
(AD-A035928; NRL-MR-3433; AR-1) Avail: NTIS HC A06/MF A01 CSCL 11/4

An interdisciplinary program has been undertaken to address the composite and adhesive materials requirements of V/STOL aircraft. The primary tasks are to develop and characterize high modulus, high toughness resins with use temperatures of 350 F to 450 F or higher, to develop fabrication technology for newly developed resin matrices for graphite-fiber reinforced composites, to develop composite failure criteria for design optimization and to establish appropriate quality control parameters. The principal accomplishments to date have been to demonstrate (a) the variation in mechanical properties obtainable by the molecular tailoring of polyphthalocyanine resins, (b) the effectiveness of NMR spectroscopy for chemical characterization of resins of complex composition, (c) the viability of resin cure using ionizing radiation and (d) the development of a unique approach to determining failure criteria for flaw growth in resin matrix composites. Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N77-25266 British Library Lending Div., Boston Spa (England).
DETERMINATION OF CONTENT OF 10 METALLIC ELEMENTS (Cr, Mn, Fe, Co, Ni, Cu, Zn, Ag, Cd, Pb) BY ATOMIC ABSORPTION METHOD
Sep. 1976 10 p Transl. into ENGLISH of French report
(BLL-M-24847-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The present experimental standard describes the determination in water of the following 10 metallic elements by atomic absorption spectrometry: chromium, manganese, iron, cobalt, nickel, copper, zinc, silver, cadmium, and lead. A method of direct determination by atomic absorption spectrometry is described. A method of determination by atomic absorption spectrometry after concentrating the metals by chelation and extraction is given. Author

N77-25267 British Library Lending Div., Boston Spa (England).
THE ELECTRO-DEPOSITION OF NOBLE METALS
H. Grossmann and G. Schaudt Nov. 1976 12 p refs Transl. into ENGLISH from Galvanotechnik (Saulgau, W. Germany), v. 67, no. 4, 1976 p 292-297
(BLL-RTS-10326) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The applicability of electrodeposits of the platinum-group metals to contact units in electrical engineering are investigated. Author

N77-25268 British Library Lending Div., Boston Spa (England).
THE PRESENT STATE OF DEPOSITION OF ZINC FROM ALKALINE AND ACIDIC ELECTROLYTES
H. G. Todt Nov. 1976 19 p refs Transl. into ENGLISH from Metalloberflaeche (Munich), v. 2, 1976 p 49-54
(BLL-RTS-10324) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The state of the art of zinc deposition is examined. Hot galvanizing of large structures and electrolytic deposition is covered. The most important electrolytes for zinc deposition and their properties are discussed. The electrolyte's efficiency, its deposition rate, and its throwing power were among the properties evaluated. High-cyanide bright zinc baths, low-cyanide bright zinc baths, alkaline, cyanide-free bright zinc baths, and acidic bright zinc baths were described. S.M.

N77-25269 British Library Lending Div., Boston Spa (England).
THE THICKNESS DISTRIBUTION OF FILMS ON PROFILED SURFACES
G. G. Weiler and T. Bolch Nov. 1976 15 p refs Transl. into English from Galvanotechnik (West Ger.), v. 67, no. 4, 1976 p 285-292
(BLL-RTS-10327) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Throwing power and in its connection to polarization and, the conductivity of an electrolyte is studied. Both of these factors are controlled by the composition of the electrolyte and are controlled with additives. These factors of influence are investigated experimentally in the example of acid copper electrolytes. Plastic models with a rectangular groove were used as cathodes. Author

N77-25270# Lockheed Missiles and Space Co., Palo Alto, Calif.
THEORY OF THE HYDRODYNAMIC STABILITY OF COMBUSTION OF FLUID SYSTEMS
S. K. Aslanov [1976] 5 p refs Transl. into ENGLISH from Dopov. AN USSR, Ser. A, Fiz.-Mat. Tekhn. Nauki (Moscow), no. 5, 1976 p 407-411
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The stability of fluid combustion relative to small hydrodynamic perturbations was investigated on the basis of a limit scheme of sudden evaporation and combustion of an ideal fluid system. The effect of viscous forces was determined to be the main stabilizing parameter. Quantitative estimates of experimentally determined limit velocities of the stable combustion of a nitroglycol type viscous fluid yield appropriate values of the stabilizing viscosity to approximately a few centripoise, which correspond to such fluid systems. The value of the viscosity grows rapidly with rise in the limit velocity, and takes on values for fast burning nitroglycerine-type viscous fluids. Author

N77-25271# Institute of Nuclear Energy Research, Lung-Tan (Taiwan).
DETERMINATION OF THE IMPURITIES IN SOME PURE METALS, ALLOYS, ORES, PLANTS, AND COATING MATERIALS WITH EMISSION SPECTROGRAPHY
Ching-Ning Chao, Shirley Lam Lee, and Hui-Tuh Tsai Jul. 1976 71 p refs
(INER-0201) Avail: NTIS (US Sales Only) HC A04/MF A01; ERDA Depository Libraries

The emission spectrographic methods are developed and compiled in analyzing diverse samples. Semi-quantitative method is used widely in general samples, such as alloys, ores, sands, plants, coating materials-etc. However, in quantitative analysis, determination of the metallic impurities contents in the pure metals depends upon the matrix effect. It is necessary to convert to the form identically for unknown and standard alike. Though the technique may be different, all of these methods are easily prepared and applied on new materials. ERA

N77-25272# California Univ., Berkeley. Lawrence Berkeley Lab.
SOLUTION CHEMISTRY AND ELECTRONIC STRUCTURE OF BINUCLEAR MANGANESE COMPLEXES Ph.D. Thesis
Stepen R. Cooper Aug. 1976 129 p refs
(Contract W-7405-eng-48)
(LBL-5513) Avail: NTIS HC A07/MF A01

The electronic structure and solution chemistry of the mixed valence manganese complexes [(L)2MnO]2(ClO4)3 where L = 2,2 prime-bipyridine or 1,10-phenanthroline were examined. Examination of the optical spectra of the mixed valent (III, IV) complexes with L = 2,2 prime bipyridine and 1,10-Phenanthroline demonstrated the presence of a broad near infrared band which is unexpected from comparison with other high spin Mn(III) complexes. Far infrared bands were tentatively assigned for

Mn(III)-N and Mn(IV)-N stretches. One vibrational mode of the Mn2O2 bridge (for the bipyridyl (III,IV) dimer) was identified at 688/cm by O18 isotopic substitution. Cyclic voltammograms of the bipyridyl and phenanthroline (III, IV) dimers show that the (III, IV) to (IV, IV) oxidation occurs in a quasi-reversible process at 1.3 V vs. SCE. Reductions to the (III, III) ions were observed, but only in the case of the phenanthroline (III, III) dimer does any measurable current occur for the reoxidation of (III, III) to (III, IV). ERA

N77-25273# California Univ., Livermore. Lawrence Livermore Lab.

VECTOR METHOD FOR LARGE SCALE CONFIGURATION INTERACTION PROBLEMS Ph.D. Thesis

Robert F. Hausman, Jr. 18 Nov. 1976 115 p refs
(Contract W-7405-eng-48)
(UCRL-52178) Avail: NTIS HC A06/MF A01

The details of the method are presented, and timing and error bounds are derived. The method is used to calculate spectra for the lithium hydride and water molecules, and is demonstrated to be comparable to standard techniques in terms of accuracy and timing. In contrast to the standard approach, the time required by the new method is demonstrated to scale linearly with the size of the multiparticle basis involved. The method is used to calculate spectra for several nuclei near Ca-48 for a variety of model spaces and effective interactions. The flexibility and desirable scaling properties of the method allow calculations to be undertaken which were heretofore prohibitively expensive or complicated. The behavior of shell-model spectra for Ca-49 with respect to the excitations allowed is investigated. Various means of describing the excitations allowed in the model wavefunctions are discussed, and a new consistent approach is described. ERA

N77-25274# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.

ELECTROCHEMICAL CLEANING OF DISCOLORED WELD ZONES IN STAINLESS STEELS

Andre Vinckier (Ghent Univ.) Jan. 1977 13 p Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-MT-116) Avail: NTIS HC A02/MF A01

Heat tint discoloration and light scale on stainless steel weldments are usually very difficult to clean off. An electrolytic etching technique, using a paste spread on the surface of the weld, seems to be a very promising technique for removing such scales and oxides very rapidly. Author (ESA)

N77-25275# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

REACTIONS BETWEEN HYDROGEN ATOMS AND HYDROPEROXYL RADICALS, PART 1 [REAKTIONEN VON WASSERSTOFF - ATOMEN MIT HYDROPEROXYL - RADIKALEN. TEIL 1]

W. Hack and H. G. Wagner Oct. 1976 50 p refs In GERMAN; ENGLISH summary
(MPIS-22/1976) Avail: NTIS HC A03/MF A01; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 10.05

The reaction of H-atoms with hydroperoxyl radicals was studied in two different types of isothermal flow reactor, with and without sampling. The carrier gas was He. The absolute concentrations of the unstable species H, O, and HO were measured by ESR. Concentration profile measurements at short reaction times gave the relative contribution of the three reactions H + O2 yields OH + OH (a); H + O2 yields H2O + O (b); and H + O2 yields H2 + O2 (c). The rate constants found are k(a) (293K) = (1.6 + or - 0.8) 10 to the 13th power (cu cm/mol sec) and k(c) (293K) = (6.7 + or - 1.5) 10 to the 12th power (cu cm/mol sec). ESA

N77-25276# Missouri Univ., Columbia. Environmental Trace Substances Research Center.

MODIFICATION OF AN ANALYTICAL PROCEDURE FOR ISOCYANATES TO HIGH SPEED LIQUID CHROMATOGRAPHY Final Report

Vogt C. R. Hastings, C. Y. Ko, and T. R. Ryan Apr. 1976 97 p refs
(Contract PHS-CDC-210-75-0052)
(PB-262675/2) Avail: NTIS HC A05/MF A01 CSCL 14B

The analysis of the industrial isocyanates using high speed liquid chromatography (HSLC) is shown and the advantages of HSLC over that of the TLC counterpart are demonstrated. Minimum detectable limit of 2 ng was observed. Linearity up to 1,600 ng was shown on the 25 cm Partisil 10 and 5 cm Partisil 5 columns. Reproducibility of repeated injections are within experimental errors. Samples are stable for at least 10 days. Column life and efficiency can be preserved by flushing the column daily and minimizing the amount of unreacted nitro reagent injected. Ureas that may serve as primary standards' can be synthesized, isolated, purified, and characterized. GRA

N77-25277# Naval Weapons Center, China Lake, Calif.

EFFECT OF INJECTOR DESIGN ON EXTERNAL BURNING OF SOLID PROPELLANTS IN MACH 2 AIRSTREAM Technical Publication, Apr. - Oct. 1976

Klaus C. Schadow and Don J. Chieze Feb. 1977 15 p refs
(AD-A035451; NWC-TP-5917) Avail: NTIS HC A02/MF A01 CSCL 21/2

Injector concepts and propellant formulations were evaluated under simulated external burning conditions in a planar, two-dimensional wind tunnel. The ratio of base pressure rise to propellant mass flow was significantly improved by reduction of the injection velocity from supersonic to subsonic speed, the use of a downstream facing step upstream of the supersonic and subsonic injector, and the use of magnesium loaded propellants. GRA

N77-25278# Battelle Columbus Labs., Ohio.

NOx FORMATION IN CO FLAMES Final Report, May 1972 - Dec. 1975

E. L. Merryman and A. Levy Jan. 1977 55 p refs
(Contract EPA-68-02-0262)
(PB-264066/2; EPA-600/2-77-008c) Avail: NTIS HC A04/MF A01 CSCL 07C

Carbon monoxide flames containing NO, ammonia, and cyanogen were profiled for NO and NO2. Effects of flame temperature and of nitrogen- and argon- 'air' were also examined. The results give evidence for prompt NO in CO flames as well as for early NO2. The prompt NO and early NO2 levels are less than in methane flames, but the same mechanism appears to explain the formation of NO2 in both flame systems. In most instances, the quantity of NO or fuel-nitrogen added to the flames can be accounted for as NO, NO2, and an unidentified nitrogen species. Analysis of the rates of depletion of ammonia and cyanogen in the CO flames yields Arrhenius coefficients equivalent to 58 and 41 kcal/mole, respectively. GRA

N77-25279# National Bureau of Standards, Boulder, Colo. Cyrogenics Div.

THERMOPHYSICAL PROPERTIES OF ETHANE, FROM 90 TO 600 K AT PRESSURES TO 700 BAR

R. D. Goodwin, H. M. Roder, and G. C. Straty Aug. 1976 330 p refs Sponsored in part by American Gas Assoc., Inc., Arlington, Va.
(PB-263885/6; NBS-TN-684) Avail: NTIS HC A15/MF A01 CSCL 07D

The Thermophysical properties of ethane are tabulated at integral temperatures over the entire range of fluid states at temperatures from 90 to 600 K along isobars to 700 bar. A new form of the equation of state is employed for the first time. Thermodynamic functions in the compressed liquid are obtained by use of specific heats along a high-density isochore, and for the saturated liquid. Use of these new specific heat data and also of new PVT data provide the first reliable set of thermodynamic functions for compressed liquid ethane at temperatures below its normal boiling point. GRA

N77-25280# Midwest Research Inst., Kansas City, Mo.

COMPREHENSIVE REPORT AND INVESTIGATION ON HELIUM USES Final Report, period ending 31 Jan. 1977

31 Jan. 1977 147 p refs
(Contract DI-14-09-0060-5152)
(PB-263515/9; BM-OFR-25-77) Avail: NTIS HC A07/MF A01 CSCL 07B

Sales of helium in 1975 were found to be 601 million cubic feet (MMcf) compared with 907 MMcf for 1976. The use categories for helium remained the same, although there was a

rearrangement of the percentage used in each of 12 use categories. Cryogenic applications accounted for almost 35 percent of the total volume used followed by pressurizing and welding at 16 percent each. Synthetic breathing mixtures was the fourth highest use category accounting for 9 percent. The study forecasts that the total volume of helium to be used in the United States in 1977 will increase to 710 MMcf, 957 MMcf by 1985, and 1,315 MMcf by the year 2000. GRA

N77-25281# AeroChem Research Labs., Inc., Princeton, N. J.
HYDRAZINE ANALYSIS USING CHEMILUMINESCENCE Final Report, 5 Jan. - 5 Jun. 1976
Hermann V. Volltrauer Sep. 1976 25 p refs
(Contract F41609-76-C-0029)
(AD-A032446; AEROCHEM-TP-341; SAM-TR-76-37) Avail: NTIS HC A02/MF A01 CSCL 21/9

The chemiluminescent reactions of ozone with hydrazine, methylhydrazine, and 1,1-dimethylhydrazine have been studied over a wide range of conditions. From the spectral and kinetic information obtained from these studies, a measuring method was arrived at which permits determining concentrations of methylhydrazine, Aerozine-50, and NO2 in the range of 0.1 to 1,000 ppm in air. The effects of various interferents were studied and are reported. Author (GRA)

N77-25282# Tri-Con Associates, Inc., Cambridge, Mass.
THE DESIGN DEVELOPMENT AND TEST OF SATELLITE, BALLOON AND ROCKET BOURNE MASS SPECTROMETER, ELECTRONIC ASSEMBLIES Final Report, Jul. 1973 - Jun. 1976
George P. Murphy 20 Sep. 1976 50 p refs
(Contract F19628-73-C-0192)
(AD-A036085; AFGL-TR-76-0214; C-127) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report reviews the design and development of the electronic assemblies used with Quadrupole Mass Spectrometers. The Mass Spectrometers are used by the Air Force Geophysics Laboratory to make composition studies of the upper atmosphere and the ionosphere. The first phase of work was directed toward a satellite instrument designed to measure both positive and neutral constituents in the range of 1 AMU to 44 AMU. Phase two was directed toward a balloon instrument which would be used to measure positive ions in the range of 10 AMU up to 400 AMU. Phase three was directed toward the design of an instrument RMS-5 which could be used on either a rocket or satellite and measure both positive and neutral constituents. Author (GRA)

N77-25283# Cranfield Inst. of Technology (England). Applied Mechanics Group.
AIR ENTERTAINMENT IN A JET FLAME STABILIZER IN SUPERSONIC FLOW Interim Report
R. A. Cookson 24 Nov. 1976 19 p refs
(Grant AF-AFOSR-2698-74; AF Proj. 9711)
(AD-A035309; AFOSR-77-0037TR) Avail: NTIS HC A02/MF A01 CSCL 21/2

An analytical technique, based upon a turbulent boundary layer separation model, has been suggested for determining the amount of air entrained into a fuel jet injected transversely into a supersonic air stream. The amount of air entrained into the fuel jet was found to vary directly with the jet induced blockage; however, the jet induced blockage and hence the amount of air entrained does have a limiting value. Author (GRA)

N77-25284# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
INTERFACIAL CHEMICAL REACTIONS IN FLOW Final Report, 1 Feb. 1973 - 30 Jun. 1976
Daniel E. Rosner Jun. 1976 16 p refs
(Grant AF-AFOSR-2487-73; AF Proj. 9750)
(AD-A035307; AFOSR-77-0036TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

This report summarizes the results of a 41 month basic research program in the High Temperature Chemical Reaction Engineering Laboratory at Yale University. Specific cases which have been studied in detail are: energy deposition to solid surfaces which are the site of highly exothermic chemical reactions, methods of extracting heterogeneous kinetic data from flow reactor experiments, the production, dispersion, and coagulation of condensation aerosoles, oxidation of refractory solids leading to volatile reaction products, solute loss or gain by refractory metals, the evaporation and combustion of liquid fuel droplet arrays, nonequilibrium crystallization kinetics in supercooled liquids, and transpiration cooling in chemically reacting environments. These phenomena are, and will continue to be, a central part of advanced engineering systems containing a dispersed condensed phase, or where the condensed phase is used for fluid confinement. Sixteen publications and two Ph. D. theses resulted from this work. GRA

N77-25285# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
BEHAVIOR OF ALUMINUM IN SOLID PROPELLANT COMBUSTION Interim Scientific Report, 1 Sep. 1975-31 Aug. 1976
E. W. Price and R. K. Sigman 24 Nov. 1976 59 p refs
(Grant AF-AFOSR-2912-76)
(AD-A035569; AFOSR-77-0050TR) Avail: NTIS HC A04/MF A01 CSCL 21/9

The behavior of various aluminum powders was observed during heating in controlled environments, using a hot stage microscope and a specially built hot plate drop apparatus (for rapid heating). Results show the effect of powder type, atmosphere, temperature, and binder type on formation of interconnected and coalesced particles, and help to clarify similar processes operative in the propellant combustion zone. Coalescence (agglomeration) tended to occur above the aluminum melting point, with the breakdown of the oxide shell on the particles (due to expansion of the melting aluminum) being a key factor. Conditions that inhibited contact of molten aluminum between particles inhibited coalescence, but usually caused particles to become interconnected. These conditions included oxidizing atmosphere or presence of propellant binder materials. Author (GRA)

N77-25286# Edgewood Arsenal, Aberdeen Proving Ground, Md.
THE APPLICATION OF POLYACRYLAMIDE GEL ELECTROPHORESIS TO THE CHARACTERIZATION OF CHOLINESTERASE ENZYMES USED IN DETECTOR KITS Technical Report, Mar. 1973 - Jun. 1974
Alan Goodman, Lawrence M. McCormack, and Hermann Martens Jan. 1977 19 p refs
(DA Proj. 1W7-62710-AD-29)
(AD-A035395; ED-TR-76123) Avail: NTIS HC A02/MF A01 CSCL 07/4

Vertical disc gel electrophoresis on polyacrylamide gel tubes has been applied to the separation and identification of cholinesterases from commercially available sources. Cholinesterase from horse serum, bovine erythrocyte, and electric eel was fractionated using the Davis method for human serum proteins. The fractions were visualized with a protein stain and two cholinesterase substrates, indoxyl acetate and indoxyl butyrate. Each enzyme had a distinctive pattern of protein bands. The eel and bovine enzymes, which have high specific activities, showed fewer bands than did the horse enzyme which has lower specific activity (lower purity). All three enzymes hydrolyzed indoxyl acetate giving colored bands. Only the horse enzyme, however, gave colored bands with indoxyl butyrate, which is in agreement with the known substrate specificities of cholinesterases. The small sample size required, the wide variations possible in gel pore size, and buffer system composition permit optimization of sensitivity and resolution for the particular enzyme being investigated and make the method useful for analytical quality control, preparative scale separations, and characterization of small amounts of enzyme from intelligence sources. GRA

N77-25287# Ohio State Univ., Columbus.
IGNITION, COMBUSTION, DETONATION AND QUENCHING OF REACTIVE MIXTURES Interim Technical Report, 1 Apr. 1975 - 31 Mar. 1976
Rudolph Edse, O. Dhiman, and E. Marasco Sep. 1976 81 p refs
(Grant AF-AFOSR-2511-73; AF Proj. 9711)
(AD-A035486; AFOSR-77-0059TR) Avail: NTIS HC A05/MF A01 CSCL 21/2

The detonation induction distances in hydrogen-air mixtures

are greatly shortened when the initial temperature of the explosive gas mixture is reduced. A new technique has been developed to calculate the effect of mixing of different gas jets on the final properties of the gas mixture. Flame speed measurements in large, nearly unconfined hydrogen-air mixtures revealed that the flame accelerates and that the speed increases with increasing volume of the explosive mixture. A shock tube has been set up to study the effect of a flame arrestor on the strength of a normal shock wave. A rectangular combustion chamber with windows is used to investigate the mechanism of deflagration quenching with various sponge and grid type flame arrestors. Further calculations have been made to determine the performance of supersonic ramjets. Author (GRA)

N77-25288# Illinois Univ., Urbana-Champaign. Dept. of Chemistry.
A STUDY OF THE ENTROPIC AND ELECTROLYTE EFFECTS IN ELECTRON TRANSFER REACTIONS
Eduardo Waisman, Gary Worry, and R. A. Marcus Jan. 1977 40 p refs Submitted for publication
(Contract N00014-75-C-0942)
(AD-A035103; TR-5) Avail: NTIS HC A03/MF A01 CSCL 07/4

The entropy of activation delta S for electron transfer reactions occurring in concentrated electrolyte solutions is calculated, taking into account the electrostatic and electronic contributions. By applying the mean spherical and exponential approximations to treat a simple model of electrolytes (hard charged spheres in a dielectric continuum), the pair distribution function is calculated. These approximations are also used to calculate the electrolyte reorganization term, since both quantities contribute to the electrostatic part of delta S. Numerical application is made to the ferrous-ferric exchange reaction in 0.55 M HClO4. Results of a preliminary electron tunneling calculation for the electron transfer are included. Reasonable agreement between observed and calculated delta S is obtained. Author (GRA)

N77-25289# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
THEORY OF HETEROGENEOUS IGNITION UNDER CONVECTIVE HEATING
18 Nov. 1976 18 p refs
(Grant AF-AFOSR-2535-73; AF Proj. 6813; AF Proj. 9711)
(AD-A035854; AFOSR-77-0040TR; Scientific-3) Avail: NTIS HC A02/MF A01 CSCL 21/2

An analysis of the heterogeneous ignition of a solid, under convective heating by a hot gas, for large values of the activation energy reveals the existence of two ignition regimes. In a first regime, for large values of the frequency factor, a short reactive stage ending in thermal runaway follows a long inert stage. For small values of the frequency factor the chemical heat release can be neglected in a first stage but not in a much longer second stage when the surface temperature is close to the hot gas temperature. A critical value is found for the frequency factor below which no thermal runaway or well defined ignition time exists. Closed form expressions for the ignition time are given for both regimes. GRA

N77-25290# Stanford Research Inst., Menlo Park, Calif. Physical Sciences Div.
THERMOCHEMISTRY OF GASEOUS COMPOUNDS OF METALS Annual Summary Report, 5 Dec. 1975 - 4 Dec. 1976
D. L. Hildenbrand Jan. 1977 15 p refs
(Contract F44620-73-C-0037; AF Proj. 2308; SRI Proj. 2445)
(AD-A035704; AFOSR-77-0064TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

Thermochemical studies of a number of gaseous metal halides and oxides have been carried out by high temperature mass spectrometry, including CaI, SrI, BaI, EuF, F2 and SmO. Dissociation energies and heats of formation are derived from the data, and the results are compared with the predictions of several theoretical models where possible. For the IIA metal iodides, the experimental dissociation energies follow trends established by the fluorides, chlorides and bromides the results are compatible with corrected Birge-Sponer extrapolations and with electrostatic model calculations. The data for BaI suggest that chemiluminescent spectra resulting from the BaI2 reaction may be due in part to the reaction of electronically-excited Ba atoms. Sublimation data for Ca2S, and vaporization data for SrI2L and BaI2L obtained by the torsion-effusion method are consistent with estimated molecular parameters of the gaseous diodide molecules, leading to accurate thermochemical data for these molecules. The results for SmO resolve a long-standing discrepancy between the dissociation energies of SmO and EuO. And finally, torsion-effusion studies of the dissociative vaporization of PbF2S yielded new thermochemical data for PbF4G. GRA

N77-25291# Vanderbilt Univ., Nashville, Tenn. Dept. of Chemistry.
APPLIED QUANTUM CHEMISTRY OF NONMETALLIC MATERIALS Final Scientific Report, 1 Feb. 1972 - 31 Oct. 1976
John R. VanWazer Dec. 1976 34 p refs
(Grant AF-AFOSR-2265-72; AF Proj. 9538)
(AD-A035703; AFOSR-77-0063TR) Avail: NTIS HC A03/MF A01 CSCL 20/10

The major advance made in the work supported under this grant has been the development of what appears to be a very generally applicable procedure for carrying out ab initio calculations employing only the orbitals of atoms, molecules and presumably also of solids, and using a potential function to describe the charge distributions of the cores and the Phillips-Kleinman pseudopotential technique to account for the other interactions between the fully described valence orbitals and the emulated core orbitals. Some advances were also made in describing quantum-chemical results obtained on various molecular structures in terms which are readily interpretable to the practicing chemist and materials scientist. Author (GRA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-25292 British Library Lending Div., Boston Spa (England).
MULTI-STAGE DIFFUSION OF CARBON INTO A STEEL SURFACE
Jordan Pavlossoglou and Hugh Burkhardt [1977] 20 p refs Transl. into ENGLISH from HTM (W. Germany), v. 31, no. 4, 1976 p 209-213 In ENGLISH and GERMAN
(BLL-M-24846-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The diffusion of carbon from a gas atmosphere into a steel surface in a sequence of stages with different conditions is studied analytically. The general solution to the two stage problem is given. It may be used as the basis for improving efficiency of the process. Author

N77-25293 British Library Lending Div., Boston Spa (England).
THE MECHANISM OF ELECTROLYTIC ZINC DEPOSITION IN CONFINED ELECTRODE SPACES
J. A. Weber and P. Tomassi Apr. 1977 21 p refs Transl. into ENGLISH from Metalloberflaeche (Munich), v. 30, no. 8, 1976 p 358-363
(BLL-RTS-10550) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The covering capacity in recesses is studied in the electroplating of metal components with complex shapes. One means of simulating the phenomena which occur in macroscopic recesses during the electroplating of metal layers was examined. It is the use of a split cell in which the cathode is inserted in a confined electrode space. Author

N77-25294 British Library Lending Div., Boston Spa (England).
DIFFUSION IN A METAL WITH THE FORMATION OF TWO DEFINITE COMPOUNDS
J. Orszagh and H. V. Poorten Apr. 1977 9 p refs Transl. into ENGLISH from Rev. Intern. des Hautes Temp. et des Refractaires (Paris), v. 11, no. 2, 1974 p 109-112
(BLL-RTS-10581) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

A correlation was established between the kinetic constants of growth of the various films and the diffusion coefficients. The calculations are applied to the diffusion of silicon in molybdenum. Author

N77-25295 British Library Lending Div., Boston Spa (England).
CORROSION PROTECTION OF TUBES VIA DIFFUSION ZINC PLATING
M. D. Zholudev, N. V. Litvinova, and N. L. Pilipenko [1976] 5 p Transl. into ENGLISH from Stal. (USSR), v. 6, 1976 p 545
(BLL-M-25477-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A particle size ratio of 1:1 was used in the mixture of zinc powder with inert filler to assure uniform coating of carbon steel tubes. A specified 100 mu thick coating is obtained at 550 C within 3 h, and at 490 C within 8 h. The best diffusion zinc plating results are obtained with a process temperature range of 490 to 520 C and a holding time of 8 to 5.5 h. Author

N77-25296 British Library Lending Div., Boston Spa (England).
CALCULATION OF THE HEAT OF FORMATION OF TERNARY METALLIC SOLUTIONS
O. I. Ostrovskii, V. A. Grigoryan, A. Ya. Stomakhin, and V. G. Dyubanov [1976] 16 p refs Transl. into ENGLISH from Izv. VUZ Chern. Met. (USSR), v. 5, 1976 p 78-84
(BLL-M-25469-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

On the basis of the positions of the theory of sub-regular solutions, with an allowance for the linear concentration function of the coordination number of the alloy, an equation is obtained for calculating the integral formation enthalpy of a ternary system from data for limiting dissolution enthalpies in boundary binary solutions and the enthalpies of the pure metals. Author

N77-25297 British Library Lending Div., Boston Spa (England).
EFFECT OF SULPHATE AND CHLORATE IONS ON THE CORROSION INHIBITION OF MILD STEEL BY A CHROMATE
S. Kawamura, N. Tanaka, and M. Nagayama 26 Nov. 1976 8 p refs Transl. into ENGLISH from Boshoku Gijutsu (Japan), v. 22, no. 12, 1973 p 500-503
(BLL-DRIC-Trans-4566-(3623.66)) Avail: British Library Lending Div., Boston Spa, Engl.

Corrosion tests were performed on mild steel at a constant concentration of calcium, chlorine, and sulfur ions while varying the pH, and using chromate ions as the corrosion inhibitor. Diagrams were constructed demarcating a corrosion domain from a noncorrosion domain. The application of this diagram in estimating the amount of chromate ions to be added for protecting mild steel in actual industrial water is evaluated. Author

N77-25298# Brush Wellman, Inc., Cleveland, Ohio.
MACHINING BERYLLIUM COPPER
[1977] 17 p
Avail: Issuing Activity

Machining operations such as turning, drilling, tappong, reaming, and milling of beryllium copper alloys are summarized. An alloy description is given and specifications are listed in tabular form. Tool materials and coolants are recommended for usage. It is concluded that beryllium copper alloys can be readily machined, with proper tools and cutting fluids, at speeds and feeds higher than generally believed. B.B.

N77-25299# Addis Translations International, Portola Valley, Calif.
BEHAVIOR OF THE ALKALI METALS AS SEMIMETALS 11. THE CRYSTAL STRUCTURE OF NaSi; AND NaGe
J. Witte and H. G. Schnering [1977] 18 p refs Transl. into English from Z. Anorg. Allg. Chem. (West Germany), v. 327, 1964 p 260-273
(BNWL-tr-216) Avail: NTIS HC A02/MF A01

The crystal structures of NaSi and NaGe were determined by modern methods. The two compounds have analogous structures, but are not rigorously isotypical. As in the compounds of the higher alkali metals, Si4 and Ge4 tetrahedra are formed here also. The surrounding of the Si and Ge particles by alkali-metal atoms is irregular. The agreement between computed and observed structure factors is good. ERA

N77-25300# Brown Univ., Providence, R. I. Div. of Engineering.
COMBINED MACROSCOPIC AND MICROSCOPIC APPROACH TO THE FRACTURE OF METALS Technical Progress Report, Jul. 1975 - Jun. 1976
J. Gurland, J. R. Rice, R. J. Asaro, and A. Needleman Jul. 1976 19 p refs
(Contract E(11-1)-3084)
(COO-3084-45) Avail: NTIS HC A02/MF A01

The conditions governing the localization of plastic flow at the onset of rupture were studied. Specific calculations of critical conditions for a number of material models were made possible through a theoretical framework by which localization is formulated as a constitutive instability, in the form of a bifurcation into a localized mode from a state of previously homogeneous deformation, and the strength of interfaces with and without the presence of dissolved segregants. Criteria for brittle versus ductile response of an interface were developed on the basis of dislocation mechanisms and thermodynamic relations, and applied to hydrogen embrittlement. Further progress has been achieved in the analysis of stress and deformation at a crack tip by the application of the large-strain elastic-plastic finite element program. ERA

N77-25301# Hanford Engineering Development Lab., Richland, Wash.
IRRADIATION AND THERMAL EFFECTS ON THE TENSILE PROPERTIES OF INCONEL ALLOY 718
A. L. Ward, J. M. Steichen, and R. L. Knecht 1976 24 p refs Presented at the ASTM 8th Intern. Symp., Effects of Radiation on Structural Materials, St. Louis, 4-6 May 1976
(Contract E(45-1)-2170)
(HEDL-SA-853; Conf-760515-6) Avail: NTIS HC A02/MF A01

The effects of neutron irradiation and out-of-flux aging on the tensile properties of wrought and weld-deposited Inconel 718 were investigated following fast-reactor (EBR-II) irradiation and thermal exposure at 538 C and 649 C for durations to 10,000 hours. Classical irradiation hardening is exhibited by this very strong material following irradiation at low temperature (approximately 400 C) to relatively low fluence and also at high temperature when very high fluence is accumulated. At test temperatures less that 538 C, ductility losses arising from helium embrittlement are evident for all irradiation conditions and at high fluences are so severe as to restrict the strength to lower than expected values. Low postirradiation strength, compared to that following out-of-flux aging for equivalent durations, suggests that irradiation accelerates the thermal overaging process at 538 C. At 649 C, the results are obscured by embrittlement and coincident limitations on strain hardenability. ERA

N77-25302# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
THE EFFECT OF ENVIRONMENT ON FATIGUE CRACK PROPAGATION UNDER GUST SPECTRUM LOADING IN ALUMINIUM ALLOY SHEET, AND THE SIGNIFICANCE FOR REALISTIC TESTING
R. J. H. Wanhill, F. A. Jacobs, and L. Schra Apr. 1976 11 p refs Presented at the Conf. on Influence of Environ. on Fatigue, London, 18-19 May 1977
(NLR-MP-76012-U) Avail: NTIS HC A02/MF A01

Flight simulation tests were carried out on 10 mm thick 2024-T3 and 7075-T6 aluminum alloy sheet specimens to study fatigue crack propagation in three environments: dry air, normal air, and salt water. The flight simulation loading was based on a gust spectrum. Two design stress levels were adopted. There was a large environmental influence, with 7075-T6 exhibiting greater sensitivity. In all three environments, the fatigue performance of 7075-T6 was inferior; however, there were complicating factors for detailed evaluation, namely, the marked influence (varying with environment) of severe flights on crack propagation rates, and the dependence of the relative effects of changing environments on both the material and design stress level. The significance of the results for improved evaluation of

materials under realistic loading conditions is discussed.
Author (ESA)

N77-25303# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
INVESTIGATION OF THE INFLUENCE OF ATMOSPHERIC EXPOSITION ON THE MECHANICAL PROPERTIES OF Al-2024 T3 AND Al-7075 T6 SHEET WITH VARIOUS SURFACE TREATMENTS
H. F. deJong May 1976 35 p refs
(VTH-210) Avail: NTIS HC A03/MF A01

Atmospheric corrosion tests were carried out on the aluminum alloys 2024 T3 and 7075 T6 with various surface treatments. The corrosion behavior and the influence of the corrosion on the mechanical properties were examined after 1, 2, and 3 years exposure. Results show that for bare material the mechanical properties decrease with increasing exposure time. Cladding and anodizing improves the corrosion resistance of the two alloys. A very good corrosion resistance is provided when the alloys are painted with a good, weather resistant paint system.
Author (ESA)

N77-25304# Brown, Boveri & Cie Aktiengesellschaft, Baden (Switzerland).
MANUFACTURING AND TESTING OF MECHANICALLY ALLOYED IN-738 Europaeische Konzertierte Aktion. Werkstoffe fuer Gasturbinen. Final Report, Jul. 1973 - Dec. 1974 [HERSTELLUNG UND PRUEFUNG VON MECHANISCH LEGIERTEM IN-738]
G. H. Gessinger [1976] 30 p refs In GERMAN Sponsored by Eidgenoess. Volkswirtschaftsdept. Prepared jointly with Bofors A.B. and Krupp (Fried.) G.m.b.H.
Avail: NTIS HC A03/MF A01

The production of Y2O3 dispersion hardened IN-738 in the laboratory is reported. The material was manufactured by mechanical alloying in argon. Powder compaction was obtained by extruding at 1060 C and 1100 C and for reduction ratios between 9:1 and 20:1. A grain size maximum was obtained by isothermal glowing at 1280 C. Tensile tests up to 1100 C and duration creep tests at 1000 C were carried out. The dispersion alloys show a higher tensile strength up to 700 C as compared to cast alloys. At higher temperatures, it slightly decreases. The creep strength exceeds that of cast alloys after 300 hours. ESA

N77-25305# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
FATIGUE STRIATION MECHANISMS IN METALS
R. J. H. Wanhill Feb. 1976 8 p refs Presented at the 2d Intern. Conf. on Mech. Behavior of Mater., Boston, Aug. 1976
(NLR-MP-76004-U) Avail: NTIS HC A02/MF A01

The mechanism of fatigue striations is discussed with particular reference to aluminum alloys. The most suitable model appears to be that of Tomkins and Biggs, and it is shown that this model can be compatible with the effects of environment and microstructure on fatigue crack propagation. Author (ESA)

N77-25306# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
CALCULATION OF STRESS INTENSITY FACTORS FOR CORNER CRACKING IN A LUG
R. J. H. Wanhill and C. J. Lof Jul. 1976 9 p refs Presented at the AGARD Struct. and Mater. Meeting on Fracture Mech. Design Methodology, London, 28-29 Sep. 1976
(NLR-MP-76021-U) Avail: NTIS HC A02/MF A01

A program for evaluating the stress intensity factors of corner cracks growing from the hole in an aluminum alloy lug loaded by a steel pin is presented. A three-dimensional finite element analysis of this configuration was made, and the results are compared with experimental fatigue crack growth calibration of the effective stress intensity factor and previously suggested analytical solutions. The program has shown reasonable agreement between the results of different methods. An experimental approach to studying crack growth behavior is advocated for future research. ESA

N77-25307# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
A QUANTITATIVE ANALYSIS OF HYDROGEN-INDUCED CRACKING Ph.D. Thesis - Tech. Hogeschool Deift, Neth.
H. P. vanLeeuwen 7 Dec. 1976 195 p refs
(NLR-TR-74084-U) Avail: NTIS HC A09/MF A01

Internal hydrogen embrittlement, stress corrosion cracking, and external hydrogen embrittlement of high strength steels applied in heavily loaded parts of aircraft structures such as wing fittings and landing gear components were analyzed. They were found to have lattice decohesion as a common source.
ESA

N77-25308# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
PROOF-LOAD TESTING ON 300 M STEEL
Wolfgang Geier and Karl O. Sippel 23 Sep. 1976 12 p refs Presented at the 43d AGARD Meeting on Struct. and Mater. Panel, London, 26 Sep. - 1 Oct. 1976 Sponsored by Min. of Defence
(MBB-UFE-1274-O) Avail: NTIS HC A02/MF A01

As a result of the fundamental considerations made on the proof-load procedure, general conditions for its basic applicability could be defined. It has been established that the procedure is sufficiently safe for use if the maximum operational load is limited or the safe crack growth interval is considered to be a statistical value. The tests results proved that the safe crack growth interval can be determined theoretically. The examination of the specific proof-load parameters provided new information on the effects and influence of the test parameters on crack propagation and residual strength. The rate of crack propagation decreases with increasing proof-load in relation to the operational load and with the proof-load interval becoming smaller. The proof-load conditions being constant, the permissible interval for the transport aircraft load spectrum is greater than that for the combat aircraft load spectrum. The experimental examination of the proof-load procedure was performed using the material 300 M exclusively. Further experiments are necessary to determine to what extent the information gathered can be applied to other materials and load spectra. In order to guarantee a crack length range large enough to measure the influence of the specific proof-load parameters on crack propagation it was necessary to perform the crack propagation tests on a very low stress level due to the very low fracture toughness of the steel 300 M. Future tests also will take into consideration a stress level adequate to the ultimate strength of the candidate material. Author (ESA)

N77-25309# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE EFFECT OF FLIGHT-BY-FLIGHT LOAD AND TEMPERATURE SEQUENCES ON RESIDUAL STATIC STRENGTH OF NOTCHED SPECIMENS IN CM003 (RR58) ALUMINUM ALLOY
F. E. Kiddle London Aeron. Res. Council Feb. 1977 16 p refs Supersedes RAE-TR-76004; ARC-36736
(ARC-CP-1360; RAE-TR-76004; ARC-36736) Avail: NTIS HC A02/MF A01; HMSO £1.25; PHI $4.90

Thin notched specimens in CM003 (RR58) plate material were tested. The effects of different fatigue stress levels, temperatures, and numbers of flight cycles were studied. Overall, the scatter in static strength was very small. Fatigue loading itself did not cause appreciable loss in static strength, but when fatigue loading was coupled with heating cycles to a maximum temperature of 125 C, the static strength was reduced by a small but statistically significant amount. Reduction in residual strength was sensitive to a number of temperature cycles and maximum temperature but appeared to be insensitive to overall stress level and creep strain. Author (ESA)

N77-25310# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
A COMPARATIVE STUDY OF THE FATIGUE PERFORMANCE OF NOTCHED SPECIMENS OF CLAD AND UNCLAD ALUMINIUM ALLOY, WITH AND WITHOUT A PRESTRESS
P. R. Edwards and M. G. Earl London Aeron. Res. Council 1977 40 p refs Supersedes RAE-TR-75148; ARC-36725
(ARC-CP-1361; RAE-TR-75148; ARC-36725) Avail: NTIS HC A03/MF A01; HMSO £2; PHI $7.65

The sensitivity of 2L71 (unclad) and 2L73 (clad) aluminum alloys to residual stresses was determined by measuring the

improvement in the constant amplitude fatigue strength of notched specimens due to the application of a single large tensile stress at the start of the test. It was found that the clad specimens were markedly less affected by the pre-stress than the unclad. This lack of response in the clad specimens was attributed to the low yield point of the cladding which reduced the susceptibility of this material to residual stresses. Author (ESA)

N77-25311# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

ALUMINIUM ALLOY DEVELOPMENT AND EVALUATION FOR AIRCRAFT STRUCTURAL PERFORMANCE

R. J. H. Wanhill and G. F. J. A. VanGestel Aug. 1976 31 p refs Presented at the Intern. Meeting on Aluminium Alloys in the Aircraft Ind., Turin, 1-2 Oct. 1976

(NLR-MP-76022-U) Avail: NTIS HC A03/MF A01

The fatigue strength, fatigue crack propagation resistance, stress corrosion resistance, fracture toughness, and residual static strength of aluminum alloys and structures for aircraft are reviewed. The most outstanding problem is whether 7000 series alloys can be used to achieve weight savings in structures customarily made from 2000 series alloys while maintaining or improving durability and damage tolerance. It is concluded that sandwich and laminated panel constructions will be favored for 7000 series alloys. Author (ESA)

N77-25312# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

APPLICATION OF FRACTURE MECHANICS TO CLEAVAGE IN HIGHLY TEXTURED TITANIUM ALLOYS

R. J. H. Wanhill 30 Aug. 1976 21 p refs

(Contract NIVR-1696)

(NLR-TR-76076-U) HC A02/MF A01

A linear elastic fracture mechanics approach provides an explanation for titanium alloy alpha cleavage at small angles as well as normal to the principal stress axis; however the complexity of the total fracture process can prevent this approach from giving the correct ranking of stress corrosion susceptibility in different orientation of strongly textured materials. Stress corrosion crack profiles in such a material indicate that a diffussing species (hydrogen) controls the location and initiation of cleavage fracture. Author (ESA)

N77-25313# Army Construction Engineering Research Lab., Champaign, Ill.

FRACTURE CHARACTERISTICS OF TWO HIGH-STRENGTH, LOW-ALLOY AND TWO STAINLESS STEELS Interim Report

J. K. Scott and E. P. Cox Jan. 1977 57 p refs

(DA Proj. 4A7-61102-AT-23)

(AD-A035629; CERL-IR-M-200) Avail: NTIS HC A04/MF A01 CSCL 11/6

The fracture characteristics of two high-strength, low-alloy structural steels ASTM A-588 and A-242 and two stainless steels AISI 416 and 174 PH were analyzed under tensile, fatigue, and impact loading conditions. The effects of hydrogen- and temper-embrittlement on the materials' behavior when fractured under tensile and fatigue conditions were investigated. The structural steels were found to be unsusceptible to temper-embrittlement. ASTM A-588 was found to be susceptible to hydrogen-embrittlement, A-242 was not found susceptible, but this could be attributed to the abnormally low toughness condition of the as-received material. The stainless steels were found to be unsusceptible to the hydrogen-charging procedure performed in this study. Mechanical tests showed large variations in values for the tempered stainless steel specimens, although the fracture surfaces appeared very similar. These findings reaffirmed the generally accepted concept that visual observation is not a sufficient method for determining temper-embrittlement, but must be combined with mechanical testing to reach valid conclusions. Author

N77-25314# Iowa Univ., Iowa City. Div. of Materials Engineering.

STRAIN RATE AND HISTORY EFFECTS ON THE DEFORMATION OF METALS Final Report, 1 Oct. 1973 - 31 Aug. 1976

K. C. Valanis and Han-Chin Wu 28 Dec. 1976 31 p refs

(Grant DAHC04-74-G-0030)

(AD-A035635; G378-DME-76-012; ARO-12097.1-A) Avail: NTIS HC A03/MF A01 CSCL 11/6

The work falls into two main categories: (1) the endochronic constitutive theory, and (2) the endochronic theory of fracture. Both these theories constitute significant innovations over what was the state of the art prior to their development. They are based on the concept of intrinsic time put forward by Valanis. Of far greater significance, however, is the fact that both theories have been demonstrated to be valid mathematical representations of material behavior as observed in the laboratory, and they unify, possibly for the first time constitutive and fracture behavior of metals. On the conceptual level they establish two conclusions: (1) the yield surface is not necessary for the description of plastic behavior, and (2) history, yet rate independent behavior, can be formulated within the framework of the theory of thermodynamics of internal variables as formulated and developed by the principal investigation. GRA

N77-25315# Ohio State Univ. Research Foundation, Columbus. Dept. of Metallurgical Engineering.

FUNDAMENTAL STUDIES OF DISSOLUTION AND PASSIVITY OF ALLOYS AND COMPOUNDS Interim Report, 1 Mar. 1975 - 29 Feb. 1976

J. B. Lumsden and R. W. Staehle Nov. 1976 44 p refs

(Contract N00014-75-C-0665)

(AD-A035271; OSURF-4131A1-1) Avail: NTIS HC A03/MF A01 CSCL 11/6

The growth kinetics of iron at open circuit potentials in phosphate, chromate, tungstate, molybdate, and nitrite solutions were investigated using the ellipsometric technique. These results were correlated with film compositions as determined using Auger electron spectroscopy. All films thickened logarithmically with time except those formed in a pH 9.1 phosphate solution. In general the less the incorporation of ions from oxyanions in the film, the more protective the film was found to be. The exception was that formed in the chromate solution. This film was very protective and had a composition which approximated that found on stainless steels. Author (GRA)

N77-25316# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.

HYDROGEN EMBRITTLEMENT OF A CYCLICALLY DEFORMED HIGH STRENGTH Al ALLOY

R. J. Jacko and D. J. Duquette Dec. 1976 37 p refs

(Contract N00014-75-C-0466)

(AD-A035135) Avail: NTIS HC A03/MF A01 CSCL 11/6

High cycle fatigue experiments have been performed on a 7075 Al alloy, principally in the T6 temper in dry air, distilled water 0.5N NaCl, and 0.5N Na2SO4 solutions as functions of pH, cathodic charging and catalyst poisoning of the hydrogen evolution reaction. All aqueous solutions appreciably lowered fatigue resistance with Cl(-) ion producing the greatest reduction in resistance and SO4(=) ion behaving essentially in the same manner as distilled water. Under cathodic charging conditions fatigue resistance is significantly reduced and both Cl(-) and SO4(=) solutions produce similar fatigue lives. Acid solutions reduce fatigue resistance to a greater degree than do basic solutions of equivalent corrosivity and a catalyst poison (As) added to Cl(-) solutions reduces fatigue resistance relative to neutral Cl(-) solutions. Fractography of specimens fatigued in aqueous environments shows that a significant amount of cleavage and quasi-cleavage occurs, the extent of these features being apparently a function of available hydrogen to the alloy free surface and to the tips of growing cracks. GRA

N77-25317# Nottingham Univ. (England). Dept. of Metallurgy.

METALLURGICAL CHANGES IN THE HIGH TEMPERATURE FRETTING OF Ni AND Ti ALLOYS Annual Report, Mar. - Dec. 1976

R. B. Waterhouse Oct. 1976 8 p

(Contracts DAJA37-75-C-2216; DAJA37-75-R-0649)

(AD-A035056; AR-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

An experimental rig has been constructed for testing the fretting fatigue behavior of two materials in use in gas turbines, viz. Ti-6Al-4V and Inconel 718. Initial tests on Ti-6Al-4V show

that the fatigue life is reduced as the temperature is raised and this is associated with the development of a layer structure on the surface. Author (GRA)

N77-25318# International Harvester Co., Hinsdale, Ill.
ISOTHERMAL HEAT TREATMENT FOR HIGH STRENGTH DUCTILE IRON CASTINGS Final Report, 27 Jun. 1973 - 17 Nov. 1975
Clarence J. Carter, Robert E. Wahlstrom, and Raymond A. Cellitti Warren, Mich. TACOM Jun. 1976 52 p
(Contract DAAE07-73-C-0308)
(AD-A035433; TACOM-TR-12167) Avail: NTIS HC A04/MF A01 CSCL 11/6

Austempered ductile iron, containing nickel, was investigated as an economical substitute for alloy steel forgings currently used as critical components in armored vehicles (M113 personnel carrier). An optimum austemper treatment evolved which resulted in a cast ductile iron which delivered 135 ksi ultimate, 97 ksi yield strength and 11% elongation. Low temperature (-40F) impact toughness was 3 ft-lbs and rotational bending fatigue strength was 62.5 ksi at room temperature. A quantity of select components, namely, suspension arm, sprocket and track shoe were cast, heat treated and finished machined to demonstrate the applicability of the manufacturing process as well as the service performance of these cast components when subjected to field testing under extreme environmental conditions.
Author (GRA)

N77-25319# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF THE MECHANICAL PROPERTIES OF WARM ROLLED ALUMINUM- 17.5 WEIGHT PERCENT COPPER ALLOY M.S. Thesis
Alfred Louis Cipriani Dec. 1976 66 p refs
(AD-A036182) Avail: NTIS HC A04/MF A01 CSCL 11/6

An aluminum-17.5 weight percent copper alloy was warm rolled to achieve refinement of the microstructure. This refined microstructure consisted of finely dispersed intermetallic Al2Cu particles with an average size of 1.2 microns in an aluminum matrix. This led to improved room temperature properties as well as the onset of superplasticity at elevated temperatures. Ductility and toughness were increased almost six-fold, despite slightly decreased yield strength and maximum compressive strength. It would appear that warm working can be used to enhance both room temperature properties and superplasticity, and that further research could maximize this improvement.
Author (GRA)

N77-25320# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Systems Support Div.
THE EFFECT OF GRAPHITE-EPOXY COMPOSITES ON THE GALVANIC CORROSION OF AEROSPACE ALLOYS Final Report, 1 Jan. 1975 - 1 Apr. 1976
Bennie A. Miller and Sylvester G. Lee Sep. 1976 47 p refs
(AD-A035029; AFML-TR-76-121) Avail: NTIS HC A03/MF A01 CSCL 11/6

The galvanic corrosion rates of selected aerospace alloys coupled to graphite-epoxy composite materials (GECM) in aerated neutral (pH7) 3.5% NaCl at 22-1 C have been studied. Galvanic current was measured by the use of a potentiostat modified to operate as a zero-resistance ammeter (ZRA). Weight-loss tests were also conducted. Four types of GECM were used along with pure graphite. Twenty-three alloys, including steels, stainless steels, aluminum, berylium-copper, nickel-base, and titanium alloys, were tested for galvanic compatibility with GECM. GRA

N77-25321# Pratt and Whitney Aircraft, East Hartford, Conn.
INFLUENCE OF SUBSURFACE DEFECTS ON FATIGUE PROPERTIES OF TITANIUM ALLOYS Semiannual Report, Apr. - Oct. 1976
C. C. Law and M. J. Blackburn 25 Oct. 1976 60 p refs
(Contract F33615-75-C-5138; AF Proj. 7353)
(AD-A035820; PWA-75-200-4017-8; SAR-3) Avail: NTIS HC A04/MF A01 CSCL 11/6

This report summarizes work performed in which the influence of specific defects on the properties of titanium alloys is studied in order to provide insight into the origin and reason for the property modifications. Description of the types of defects that have been encountered were identified in the first semi-annual report. This has been used to establish an experimental and analytical program designed to gain insight into the nature and effect of two specific defects on subsequent mechanical properties. These two defects are, firstly small discontinuities that under cycle loading lead to rapid nucleation and growth of cracks. The appearance of the fatigue fracture surface has lead to the term 'cleavage rosette' to describe the failure characteristics. The second defect is the better characterized structural discontinuity that occurs in alpha beta processed titanium alloys and termed beta fleck. The major influence of these defects are on the fatigue properties of the material. GRA

N77-25322# Army Construction Engineering Research Lab., Champaign, Ill.
AN INVESTIGATION OF THE SUSCEPTIBILITY OF POST-TENSIONING CABLES TO STRESS-CORROSION CRACKING Final Report
C. Hahin, J. Gambill, and J. K. Scott Jan. 1977 14 p refs
(DA Proj. 4A7-62719-AT-41)
(AD-A035258; CERL-TR-M-199) Avail: NTIS HC A02/MF A01 CSCL 13/3

Post-tensioning cables having ultimate tensile strength (UTS) of 270 ksi (1862 MPa) and satisfying ASTM Standard A-416 were stressed to 80 to 95 percent UTS and exposed to 3.5 percent sodium chloride and saturated calcium hydroxide solutions, where pH values ranged from 8 to 12.5. After 900 hours, since no failures were experienced, cables were forced to rupture. No appreciable reduction in strength resulted, except in cables that were artificially notched (strength losses were not due to corrosion). However, rapid failures at 95 percent UTS occurred when cables were immersed in a dilute hydrochloric acid solution where pH values ranged from 1 to 2. Time-to-failure at pH 2 averaged about 100 hours, whereas at pH 1 time-to-failure was about 1 hour. GRA

N77-25323# TRW, Inc., Cleveland, Ohio. Materials Technology.
CLOSED DIE FORGING OF POWDER METAL PERFORMS COMPARISON OF P/M FORGING SYSTEMS Final Report
Frank T. Lally and J. Ronald Russell Dec. 1976 67 p refs
(Contract DAAA08-75-C-0070)
(AD-A036054; ER-7774-F; AOD-TR-76-002) Avail: NTIS HC A04/MF A01 CSCL 11/6

The project was aimed at establishing the potential usefulness of existing standard forge shop equipment for producing precision powder metal (P/M) forgings. The accelerator for the M85 machine gun was used as the demonstration component. The minimum deformation type tooling for hydraulic press forging the accelerator was adapted for service in a mechanical crank type press and a steam drop forging hammer. A die set was constructed which provided hydraulic cushions to absorb the excess force generated during forging. The die set also provided an ejection mechanism to recover the completed forging and incorporated provisions for accurate alignment of punch and die. A number of ordnance components were identified as candidates for P/M forgings and facility requirements were defined. The mechanical press was found to be superior to either the hydraulic press or steam drop hammer for producing this type of precision forging.
Author (GRA)

N77-25324# Watervliet Arsenal, N.Y.
MECHANISM OF EMBRITTLEMENT AND BRITTLE FRACTURE IN LIQUID METAL ENVIRONMENTS
M. H. Kamdar Jan. 1977 51 p refs
(DA Proj. 1L1-61102-AH-54)
(AD-A037720; WVT-TR-77004) Avail: NTIS HC A04/MF A01 CSCL 20/11

Polycrystals and single crystals of normally ductile metals fail in a catastrophic brittle manner when exposed to certain surface active liquid metal environments. The fracture mode changes from ductile to intergranular or transgranular mode or both. In some instances, propagation of cracks in liquid metal environments occur at speeds of order 100 cm/sec. Such effects are generally recognized as the phenomena of 'Liquid Metal Embrittlement'. Liquid metal embrittlement is presently considered to result from liquid metal 'adsorption-induced reduction in cohesion' of atomic bonds at regions of high stress concentrations in a solid, such as at the tip of cracks or at the sites of crack

nucleation. The prerequisites for embrittlement are the same as those for brittle fracture and liquid metal embrittlement is considered a special case of brittle fracture rather than a diffusion or a corrosion type of phenomena. This paper presents some theoretical considerations (1) concerning the 'reduced-cohesion' mechanism of embrittlement and (2) embrittlement to be a special case of brittle fracture. Experimental results utilizing ideal embrittlement systems in support of the mechanism and also in support of various brittle fracture criteria are presented and discussed. Author (GRA)

N77-25325# Manlabs, Inc., Cambridge, Mass.
NOISE ABATEMENT AND INTERNAL VIBRATIONAL ABSORPTION IN POTENTIAL STRUCTURAL MATERIALS Semiannual Report, 1 Mar. - 1 Sep. 1976
L. Kaufman, S. A. Kulin, and P. P. Neshe Nov. 1976 91 p refs
(Contract DAAG46-74-C-0048; ARPA Order 2555)
(AD-A035692; AMMRC-CTR-76-40; SAR-5) Avail: NTIS HC A05/MF A01 CSCL 11/6

Efforts have been directed toward identifying potential structural materials which can combine high strength and damping characteristic in the audible range. Cobalt-iron alloys with additions of aluminum and manganese, copper-aluminum-nickel alloys, iron-chromium-aluminum alloys, titanium-nickel alloys, and several commercial steel compositions have been investigated. The range of yield strengths and loss factors which are attainable exceed currently available commercial materials. Measurements of the enthalpy of transformation in a thermoelastic Cu- Al- Ni alloy has been conducted over a range of grain size and sample size to assess the stored elastic strain energy. Studies of the magnetic domain wall configuration in a cobalt-iron alloy have been carried out to evaluate the contribution of domains to damping in this alloy. The hull of a one-sixth scale dynamic model of an armoured personnel carrier is being fabricated from a high damping iron-chromium-aluminum for evaluation over a range of vibrational frequencies simulating operation. A torpedo propeller has been cast from a high damping cobalt-iron alloy for evaluation in a simulated vibration test. Author (GRA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-25326 British Library Lending Div., Boston Spa (England).
TREEING PHENOMENA IN ORGANIC INSULATING MATERIALS
K. Kudo, S. Kinatano, and S. Yamaguchi [1977] 31 p refs Transl. into ENGLISH from a research report by the faculty of engineering, Meiji Univ., 1972 p 271-278, 279-287
(BLL-OA-Trans-1448-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

A dendritic partial fracture which develops into a through fracture is formed wherever a local high level electric field is present on the surface or inside an organic insulator. The temperature dependence of this treeing phenomena on the impression of alternating voltages and on the impression of an impulse voltage having a standard waveform is investigated. Solid insulators used are polyethylene, polypropylene, and polymethyl methacrylate. Author

N77-25327 British Library Lending Div., Boston Spa (England).
CHEMICAL AND TRIBOCHEMICAL BEHAVIOUR OF LIQUID LUBRICANTS
B. Dimitrov Sep. 1976 13 p refs Transl. into ENGLISH from Schmierungstechnik (West Germany), v. 6, no. 5, 1975 p 151-156
(BLL-CE-Trans-6913-(9022.090)) Avail: British Library Lending Div., Boston Spa, Engl.

Various aspects of chemical corrosion and corrosive wear and their effect on the tribological behavior of the rubbing partners were examined. Particular attention was paid to wear-reducing and HD additives which suppress the adhesive and total wear by controlled corrosive attack. Author

N77-25328 British Library Lending Div., Boston Spa (England).
INSTRUCTIONS FOR USE: ADHESIVE EP 250 FOR STRAIN GAGES
Dec. 1974 8 p Transl. into ENGLISH from German Leaflet 214.00 - 1007, Dec. 1974
(BLL-NEL-TT-2704-(6075.461); BLL-LTS-Trans-1154/76) Avail: British Library Lending Div., Boston Spa, Engl.

The adhesive EP250, a heat setting two component epoxy resin, developed for strain gage technology was studied. The adhesive makes possible the full use of the accuracy offered by the precision strain gages consisting of phenolic resins with glass fibers. The adhesive is also applicable without restrictions for the universal strain gages of polyimide and standard gages of phenolic resins with cellulose fibers, and acrylic resins with cellulose fibers. Others areas of review include: (1) preparation of surfaces to be jointed, (2) preparation of the strain gage, (3) sticking process, and (4) storage and precautionary measures. B.B.

N77-25329# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE CONSTRUCTION OF A SINGLE RELAXATION TIME SPECTRUM FOR POLYMER MATERIALS
A. F. Kreger and Iu. O. Ianson 1977 5 p refs Transl. into ENGLISH from Mekhan. Polimerov (Riga), no. 1, 1977 p 15-18
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The existing experimental results on the investigation of rigid polymer materials under high-speed quasistatic loading, relaxation and creep, as well as the generalized curves obtained by the use of temperature-time analogy were analyzed. They show that the deformative characteristics of polymers (for example, the secant modulus and pliability) vary within a time of several tens of microseconds and decades. Author

N77-25330# California Univ., Berkeley. Lawrence Berkeley Lab.
SURFACE CHARACTERIZATION OF CERAMIC MATERIALS
G. A. Somorjai and M. Salmeron 24 Sep. 1976 34 p refs Presented at 6th Intern. Symp. on Ceramic Microstruct. 176, Berkeley, California, 24 Aug. 1976
(Contract W-7405-eng-48)
(LBL-5475; Conf-760856-2) Avail: NTIS HC A03/MF A01

Techniques available to characterize the structure and chemical composition of surfaces of ceramic materials are described. These techniques utilize electron scattering and scattering of ions from surfaces. Low-energy electron diffraction is used to determine the surface structure, Auger electron spectroscopy and other techniques of electron spectroscopy (ultraviolet and photoelectron spectroscopies) are employed to determine the composition of the surface. In addition the oxidation state of surface atoms may be determined using these techniques. Ion scattering mass spectrometry and secondary ion mass spectrometry are also useful in characterizing surfaces and their reactions. ERA

N77-25331# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.
OIL ANALYSIS PROGRAM GEAR BENCH TESTING Final Report
P. J. Mangione Aug. 1976 32 p refs
(AD-A036148; NAPTC-PE-90) Avail: NTIS HC A03/MF A01 CSCL 11/8

The objective of the Navy Oil Analysis Program is to determine the feasibility of identifying wear and failure modes in oil wetted systems by oil analysis evaluation and detection techniques. As part of this effort the NAPTC conducted gear bench tests which simulated wear, scuffing/scoring, and fatigue failure modes in typical mechanical gearing systems. This report presents oil sampling identification/spectrometric oil analysis results and related test data including failure criteria which will be necessary in the total program. Author (GRA)

N77-25332# Massachusetts Inst. of Tech., Cambridge.
FRACTURE BEHAVIOR OF FIBERGLASS REINFORCED PLASTICS SUITABLE FOR HULL MATERIALS
John F. Mandell and Frederick J. MacGarry Dec. 1976 120 p refs

(Grant NOAA-04-6-158-44007)
(PB-264019/1; MITSG-75-25; NOAA-77011906) Avail: NTIS HC A06/MF A01 CSCL 13J

The effects of material and geometric variables, time and temperature on the fracture toughness of the fiberglass laminates were studied along with cyclic fatigue crack propagation and marine environment effects. In each case, the mechanisms of fracture in fiberglass hull materials were examined with a view toward preventing catastrophic failures. GRA

N77-25333# Florida Univ., Gainesville. Dept. of Materials Science and Engineering.
THE SCIENCE OF CERAMIC PROCESSING BEFORE FIRING Final Report, 1 Oct. 1974 - 30 Jun. 1975
George Y. Onoda, Jr. and Larry L. Hench 24 Jan. 1977 16 p Proc. of 10th Ann. Univ. Conf. on Ceramic Sci., Gainesville, Fla., 27-30 Jan. 1975
(Grant DAHC04-75-G-0014)
(AD-A035631; ARO-12584.1-MS) Avail: NTIS HC A02/MF A01 CSCL 11/2

This report summarizes the outcome of the tenth annual University Conference on Ceramic Science. The subject was 'The Science of Ceramic Processing Before Firing'. The highlights of the conference papers are summarized and a list of participants is provided. Author (GRA)

N77-25334# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
SPECTROSCOPIC ANALYSIS OF ELECTRICALLY POLARIZED POLY (ACRYLONITRILE)
S. I. Stupp and S. H. Carr 20 Jan. 1977 33 p refs Submitted for publication
(Contract N00014-75-C-0963; NR Proj. 051-599)
(AD-A035859; TR-3) Avail: NTIS HC A03/MF A01 CSCL 11/9

Electrically polarized and unpolarized films of poly Acrylonitryle have been investigated by both infrared attenuated total reflection ATR and thermally stimulated discharge TSD. ATR analysis of PAN films has been aimed at explaining the molecular origin of thermally stimulated currents, and consequently that of phenomena contributing to electrical polarization in this material. Preferred orientation of nitrile dipoles along the thickness direction (Applied electric field direction) has been detected by ATR in both polarized and unpolarized films. It is suggested that dipolar alignment in unpolarized solvent cast films results from internal electric fields associated with space charges. The observed orientational anisotropy is found to disappear gradually as films (both polarized and unpolarized) are heated from ambient temperature to 100 C and rotational motion in the backbone is thermally activated. TSD currents observed in this thermal range are thus associated with randomization of molecular dipoles. TSD currents observed above 100 C are suggested to originate from drift of space charges, since both an isotropic orientation of dipoles and onset of considerable diffusion are detected by ATR in this temperature range. GRA

N77-25335# California Univ., Berkeley. Dept. of Chemical Engineering.
VISCOELASTIC PROPERTIES OF ENTANGLED POLYMERS. 2: THE INTERCHAIN-INTRACHAIN ENTANGLEMENT MODEL
S. D. Hong, D. R. Hansen, M. C. Williams, and M. Shen 1 Dec. 1976 32 p refs
(Contract N00014-75-C-0955)
(AD-A035314; TR-10) Avail: NTIS HC A03/MF A01 CSCL 07/3

Our earlier model of entangled chain dynamics represented the elastic effects at entanglement points as a coupling with the surrounding medium, which was propagated weakly to every other entanglement site on the parent chain. In this way, a great variety of linear viscoelastic phenomena could be successfully predicted, with the only significant deficiency being a quantitative failure in curve-fitting the local minimum in dynamic loss modulu, G(omega). Here we introduce the 'intrachain entanglement' or the 'internal entanglement' in which the parent chain entangles directly with itself. Elastic forces between pairs of internal entanglements are assumed to be stronger than those with the medium ('external entanglements'). Predictions of the new model are compared with rheological data on monodisperse polystyrene. Good agreement was obtained between theory and experiment, including G(omega). Author (GRA)

N77-25336# California Univ., Berkeley. Dept. of Chemical Engineering.
DYNAMIC MECHANICAL PROPERTIES OF SOLVENT CRAZED POLYSTYRENE
B. A. Shah, G. Akovali, and M. Shen 1 Sep. 1976 11 p refs (Contract N00014-75-C-0955)
(AD-A035313; TR-8) Avail: NTIS HC A02/MF A01 CSCL 07/3

The dynamic mechanical properties of polystyrene crazed in various organic solvents were determined on a Rheovibron Viscoelastometer. It was found that the loss curves for polystyrene crazed in the presence of ethylene glycol, diethylene glycol and triethylene glycol were similar to the uncrazed polystyrene. However, when 1-pentanol was used as the solvent, there is a substantial decrease in the glass transition temperature of polystyrene. The latter evidence is in clear agreement with the plasticization mechanism of solvent crazing. However, the former data with the glycols seem to indicate that the surface stabilization mechanism cannot be ruled out. Author (GRA)

N77-25337# California Univ., Berkeley. Dept. of Chemical Engineering.
VISCOELASTIC PROPERTIES OF POLY(ETHYLENE-G-STYRENE)
J. Diamant, D. R. Hansen, and M. Shen 1 Nov. 1976 25 p refs Submitted for publication
(Contract N00014-75-C-0955)
(AD-A035300; TR-9) Avail: NTIS HC A02/MF A01 CSCL 07/3

The Time Temperature Superposition Principle was applied to the stress relaxation isotherms of two samples of poly-(ethylene-g-styrene). The graft copolymers were prepared by mutual irradiation of polyethylene powder and styrene monomer in a nuclear reactor source, one containing 12% (PEGS/12) and the other 58% styrene (PEGS/58). The shift factor data, when plotted versus the reciprocal of temperature, yielded a straight line in the region of -20C, and 70C, with an activation energy of 32 kcal/mole. From the viscoelastic master curves the relaxation spectra were determined by the second approximation method. The dynamic moduli, computed by the interconversion technique, can then be shifted from the logarithmic time axis to temperature axis by using the shift factor data obtained in stress relaxation isotherms. The calculated curves were compared with the experimental dynamic mechanical data. Agreement was semi-quantitative for the storage moduli, but only qualitative for the loss moduli. Author (GRA)

N77-25338# Pennwalt Corp., King of Prussia, Pa. Research and Development Dept.
INORGANIC COORDINATION POLYMERS. 21: MANGANESE 2, COBALT 2, NICKEL 2, COPPER 2, AND ZINC 2[BIS(N-PHENYLAMINOMETHYL) PHOSPHINATES]. EFFECTS OF COORDINATING SIDE GROUPS
J. L. Eichelberger and H. D. Gillman Jan. 1977 20 p refs Submitted for publication
(Contract N00019-69-C-0122)
(AD-A035099; TR-19) Avail: NTIS HC A02/MF A01 CSCL 07/3

The metal (II) bis(bis(N-phenylaminomethyl)phosphinates) M(OP(CH2NHC6H))2-O)2 (with Mg, Mn, Co, Ni, Cu, and Zn) have been investigated. The manganese, cobalt and nickel derivatives all have similar structures with octahedrally coordinated metal centers, the copper derivative is probably tetragonally distorted octahedral, and the zinc derivative is tetrahedral. All of these compounds contain some coordinating amine groups except the zinc complex in which no amine groups coordinate. Most likely, all of these compounds contain symmetrically bridging O,O: phosphinate groups. The thermal stabilities of these complexes are markedly different from one another and appear to be dependent on the ligand field stabilization energies but not on the chelation of the amine groups. Author (GRA)

N77-25339# Pennwalt Corp., King of Prussia, Pa. Research and Development Dept.
INORGANIC COORDINATION POLYMERS. 22: CHROMIUM (III) BIS(PHOSPHINATE) POLYMERS CONTAINING SOME ORGANIC ANIONS
H. D. Gillman and P. Nannelli Jan. 1977 15 p refs
(Contract N00014-69-C-0122)
(AD-A035100; TR-20) Avail: NTIS HC A02/MF A01 CSCL 07/3

The preparation and characterization of a variety of chromium(III) bis(phosphinate) polymers, alkoxides, aryloxides and carboxylate derivatives were prepared by the reaction of mu-chloro-bis(mu-phosphinato)-chromium(III) with the appropriate alcohol or carboxylic acid in the presence of excess triethyl amine in THF. These materials are generally soluble in organic solvents in which their molecular weights range from 1,600 to 10,600. In both the solid state and in solution these polymers are hydrolytically stable. Their properties suggest octahedral chromium (III) centers bridged by double phospinate bridges as well as bridging (L) groups. GRA

N77-25340# Utah Univ., Salt Lake City. Dept. of Materials Science and Engineering.
MOLECULAR BEHAVIOR STUDIES OF GLASSY POLYMERS UNDER STRESS Final Report, 1 May - 31 Jul. 1976
William O. Statton 23 Nov. 1976 335 p refs
(Grant AF-AFOSR-2827-75)
(AD-A035474; UTEC-76-274; AFOSR-77-0047TR) Avail: NTIS HC A14/MF A01 CSCL 07/3

Molecular behavior of two structurally different glassy polymers, polystyrene and polycarbonate has been studied under tensile stress, cyclic fatigue and in crazing conditions. This has been accomplished by the use of dynamic fourier transform IR spectroscopy and standard characterization techniques. The study of polystyrene revealed that bulky phenyl side groups on the polymer backbone dictate its mechanical behavior by partially interlocking the chains, causing distortions of phenyl groups and breakage of phenyl interlockings. Further, these interphenyl interferences have been found to depend on processing conditions particularly the orientation conditions. In cyclically fatigued PS films, better packing of polymer chains occurs even though serious molecular level damage occurs in the process. In unoriented films, bulky phenyl side groups highly restrict the chain mobility and therefore stress-relief occurs by crazing of the polymer at the surface. In polycarbonate polycarbonate polymer, the stresses which are distributed are a large number of polymer chains. Because of its higher free volume. Fatigued PC films show a shift of alpha and beta relaxation peaks towards lower temperatures indicating an increase in free volume through molecular chain scission. Fatigue-crazing and solvent-crazing in PC occurs via different molecular mechanism, with an extensive damage occurring during the cyclic fatigue. Author (GRA)

N77-25341# Sheldahl Co., Northfield, Minn.
POLY-PLUS DEVELOPMENT PROGRAM Final Report, 1973 - 1976
W. L. Smith Jan. 1977 103 p refs
(Contract N00014-72-C-0494)
(AD-A035227) Avail: NTIS HC A06/MF A01 CSCL 04/2

A compilation of five reports concerning the application of scrim to polyethylene film in order to create a lightweight gas barrier to be used in fabricating balloons for lifting very heavy payloads into the stratosphere for scientific purposes.
Author (GRA)

N77-25342# Thames Polytechnic, London (England). School of Chemistry.
NEW POLYORGANOSILOXANES PREPARED FROM MINERAL SILICATES Annual Report, Dec. 1975 - Dec. 1976
B. R. Currell Sep. 1976 31 p refs
(Contract DA-ERO-75-G-019; DA Proj. 1T1-61102-B-32D)
(AD-A036013; AR-2) Avail: NTIS HC A03/MF A01 CSCL 11/9

The controlled heat treatment of the polyorganosiloxane prepared by the direct trimethylsilylation of the mineral biotite has resulted in a range of materials. These polymeric products include a mobile liquid several intermediate products with variations in viscosity and molecular weight and white solid organosiloxanes with variable amounts of hydrocarbon present. Detailed analysis of these products, and the volatile components given off during heating, by gas liquid, and high performance liquid chromatography has enabled us to identify semi-quantitatively the components present in our original trimethylsilylation reaction product. GRA

N77-25343# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
DEVELOPMENT OF AN AKALINE-INHIBITED EPOXY PRIMER FOR MAGNESIUM ALLOYS Final Report
David F. Pullex 9 Dec. 1976 24 p refs
(AD-A036010; NADC-76297-30) Avail: NTIS HC A02/MF A01 CSCL 11/3

Current primer coatings, using metallic chromates as the sole corrosion inhibitors, have not provided adequate protection for magnesium alloys on major aircraft components. However, it has been found that such metals can be protected by an epoxy formulation similar to specification MIL-P-23377 if a specific ratio of magnesium oxide to strontium chromate is substituted for the existing inhibitive filler. Salt-spray tests, with and without sulfur dioxide additions, have been used to demonstrate the effectiveness of this material on wrought and cast magnesium alloys. In addition, other laboratory tests have verified that this coating is capable of meeting the performance requirements of current tactical aircraft. Author (GRA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N77-25344 Materials Research Labs., Melbourne (Australia).
THE DETERMINATION OF SODIUM CRYOLITE IN PROPELLANTS VIA THE ALUMINIUM CONTENT
R. G. Davidson and F. D. McPherson Feb. 1977 13 p refs
(MRL-TN-393) Copyright. Avail: Issuing Activity

The determination of the sodium cryolite content in propellant via the aluminum content was investigated. Two methods for the determination of aluminum were examined and the results were compared with those obtained from the determination of sodium cryolite via its fluorine content by the standard distillation method. The two methods for the determination of aluminum were complexometric titration, and spectrophotometry with 8-hydrooxyqunoline. The results show that sodium cryolite in propellant may be determined more rapidly and more easily via the aluminum content than via the fluorine content. Author

N77-25345*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL STABILITY OF SOME AIRCRAFT TURBINE FUELS DERIVED FROM OIL SHALE AND COAL
Thaine W. Reynolds Washington Jun. 1977 33 p refs
(NASA-TM-X-3551; E-9070) Avail: NTIS HC A03/MF A01 CSCL 21D

Thermal stability breakpoint temperatures are shown for 32 jet fuels prepared from oil shale and coal syncrudes by various degrees of hydrogenation. Low severity hydrotreated shale oils, with nitrogen contents of 0.1 to 0.24 weight percent, had breakpoint temperatures in the 477 to 505 K (400 to 450 F) range. Higher severity treatment, lowering nitrogen levels to 0.008 to 0.017 weight percent, resulted in breakpoint temperatures in the 505 to 533 K (450 to 500 F) range. Coal derived fuels showed generally increasing breakpoint temperatures with increasing weight percent hydrogen, fuels below 13 weight percent hydrogen having breakpoints below 533 K (500 F). Comparisons are shown with similar literature data. Author

N77-25346*# National Aeronautics and Space Administration. Pasadena Office, Calif.
NITRAMINE PROPELLANTS Patent Application
Norman S. Cohen (JPL) and Leon D. Strand, inventors (to NASA)

(JPL) Filed 16 May 1977 16 p
(Contract NAS7-100)
(NASA-Case-NPO-14103-1; US-Patent-Appl-SN-797210) Avail: NTIS HC A02/MF A01 CSCL 21I

Nitramine propellants absent a pressure exponent shift in the burning rate curves are prepared by matching the burning rate of a selected nitramine or combination of nitramines within 10% of burning rate of a plasticized active binder so as to smooth out the break point appearance in the burning rate curve. NASA

N77-25347# Lockheed Missiles and Space Co., Palo Alto, Calif.
THEORY OF THE STABILITY OF SOLID PROPELLANT COMBUSTION TAKING PHASE INTERACTION INTO ACCOUNT
S. K. Aslanov [1976] 5 p refs Transl. into ENGLISH from Dopov. Akad. Nauk Ukr RSR, Ser. A (USSR), no. 8, 1976 p 701-704
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The stability problem is solved successfully in a conjugate formulation, when it is essential to take account, on the one hand, of the thermal inertia of the condensed phase of powder having a variable surface temperature, and on the other hand, the effect of interaction between the solid propellant material, perturbed in temperature respects, and the gas phase which is still in the hydrodynamic perturbed state. The pressure fluctuations originating spontaneously in the gas phase become valuable, in principle, because of the dependence of the mass rate of combustion and the surface temperature on the pressure. Author

N77-25348# Aerojet Solid Propulsion Co., Sacramento, Calif.
FLEXIBLE CASE-GRAIN INTERACTION IN BALLISTIC WEAPON SYSTEMS. VOLUME 1: TECHNICAL ACCOMPLISHMENTS Final Report, Apr. 1972 - Mar. 1976
Kenneth W. Bills, Jr., Samuel W. Jang, and Harold Leeming Oct. 1976 246 p refs
(Contract F04611-72-C-0055)
(AD-A032635; ASPC-1953-81-F-Vol-1; AFRPL-TR-76-57-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 21/9

The original objective of this program was to establish the reliability of existing structural analysis techniques for the prediction of stresses and strains in solid propellant grains. This was to be accomplished by fully instrumenting a full-scale Minuteman III Stage III motor with the latest stress-strain instrumentation, subjecting it to various test conditions (Thermal cycling, handling, vibration, pressurization) and then comparing the experimental results with predicted values. This was to be a 'closed envelope' approach in which the reduced data from the gages were to be kept secret until the final assessment phase of the program. The revised program included diagnostic evaluations to isolate error sources, a system rework to correct and/or modify questionable components, a parallel laboratory investigation of specific gage characteristics and, finally, verification of the stability of the reworked system. From the results of the diagnostic tests it was determined that the major anomalies observed could be traced to the gages-lead-wire-solder junction combinations. Use of an acid flux in soldering the stainless steel leadwires provided a potential for corrosion to occur as the junction aged. The reworked system which included crimped spade-lug junctions in place of the leadwire solder joints, a new DAS and revised operational procedures showed a substantial improvement in system stability, exhibiting an average drift rate of 0.5% of full scale output per month. GRA

N77-25349# Aerojet Solid Propulsion Co., Sacramento, Calif.
FLEXIBLE CASE-GRAIN INTERACTION IN BALLISTIC WEAPON SYSTEMS. VOLUME 2: SOLID PROPELLANT GRAIN INSTRUMENTATION SYSTEM DESIGN AND APPLICATION Final Report, Apr. 1972 - Mar. 1976
Harold Leeming, Kenneth W. Bills, Jr., and Samuel W. Jang Oct. 1976 147 p
(Contract F04611-72-C-0055)
(AD-A032636; ASPC-1953-81-F-Vol-2; AFRPL-TR-76-57-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 21/9

The experience and knowledge gained from this and similar programs were compiled in this volume, which was designed as a guide to the experimental stress analysis of solid propellant grains. The effect was divided into six major phases. The first phase is directed to the program manager and the project engineer, who must make the initial decision to conduct such an effort. The second and third phases are more elaborate versions of Phase I, but involve realistic plans for instrumenting and testing the units. Phase III is an evaluation of these plans to assure that the measurements can be obtained with the available facilities and test equipment. Phases IV and V define the extensive work required to carry out the test plans, while Phase VI includes the reduction of the test data and an assessment of the quality of the testing and the value of the results. GRA

N77-25350# Oak Ridge National Lab., Tenn.
THERMODYNAMIC INVESTIGATION INTO STEAM-METHANE REFORMING AND THE SYNTHESIS OF METHANE FROM CARBON MONOXIDE AND HYDROGEN
L. H. Wu and M. H. Lietzke Nov. 1976 65 p refs
(Contract W-7405-eng-26)
(ORNL-5225) Avail: NTIS HC A04/MF A01

The steam-methane equilibrium reaction was investigated by considering both methane synthesis from hydrogen and carbon monoxide and by considering steam-methane reforming from methane and steam. A FORTRAN computer program was written to carry out all the calculations over a wide range of temperatures, pressures, and initial compositions. The products of each process as a function of pressure, temperature, and starting ratio of reactant gases were calculated, as well as the heats involved. In both processes the minimum ratios above which no carbon precipitates were determined as a function of temperature and pressure were given. ERA

N77-25351# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Propulsion Directorate.
THERMAL STRESS: A NARROW BAND RANDOM LOAD IN A SOLID PROPELLANT CYLINDER
Robert A. Heller 7 May 1976 38 p refs
(AD-A035317; RK-7T-1) Avail: NTIS HC A03/MF A01 CSCL 21/9

The stresses in a large diameter solid propellant cylinder encased in a steel shell and subjected to random surface temperatures are analyzed. A plane strain elastic solution coupled with random process theory is used to determine the mean and variance of thermal stresses as well as the response to a sinusoidal input temperature in the interior of the cylinder. It is shown that stress components are nearly constant in amplitude at various depths and that the diurnal cycle produces insignificant stress variations. GRA

N77-25352# Auburn Univ., Ala. Dept. of Chemistry.
CARBORANE BURNING RATE MODIFIERS Final Report, 28 Aug. 1975 - 1 Oct. 1976
William E. Hill and F. A. Johnson 21 Dec. 1976 14 p refs
(Contract N00024-75-C-5318)
(AD-A035404) Avail: NTIS HC A02/MF A01 CSCL 21/9

Derivatives of 1-2 dicarba-closo-dodecaborane (12) capable of being chemically bonded to the double bonds in polybutadiene polymers have been synthesized and characterized. These derivatives do bond to the polymer backbone. Kinetic studies on formation of ortho-carborane have been carried out. Author (GRA)

N77-25353# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
SOLID PROPELLANT IGNITION AND UNSTEADY COMBUSTION PROCESSES Final Report, 1 Oct. 1973 - 30 Sep. 1976
Leonard H. Caveny and Martin Summerfield Nov. 1976 41 p refs
(AF Proj. 9711)
(AD-A035439; AFOSR-77-0042TR) Avail: NTIS HC A03/MF A01 CSCL 21/9

The research carried out under the grant was aimed at furthering the scientific understanding of nonsteady propellant combustion behavior in rocket motor chambers. Controlled nonsteady flow and burning conditions were produced in

laboratory-scale solid rocket motors by developing a device that modulated the throat area of the primary nozzle. Modulation frequencies up to 2400 Hz were obtained. The modulated throat rocket motor is being used to acquire data using AP composite propellant grains. Cold flow tests were used to study the acoustic modes and nozzle discharge characteristics. Computerized techniques were developed for conducting spectral analyses of head-end and nozzle-end pressure data. In addition, the equations describing the nonsteady one-dimensional gas dynamics and propellant combustion were formulated, and a comprehensive numerical solution was developed. The present solution takes into account the couplings among the oscillating nozzle flow, the nonsteady chamber flow, and erosive burning. Since pressure and velocity oscillations can be made to occur and decay in high loading density rocket motors with realistic grain configurations, the experiment is expected to produce propellant/chamber response functions that are relatively easy to interpret, compared to the difficult to interpret T-burner response functions. GRA

N77-25354# Ballistic Research Labs., Aberdeen Proving Ground, Md.
NUMERICAL SOLUTION OF THREE SOLID PROPELLANT COMBUSTION MODELS
Douglas E. Kooker and Carl W. Nelson Jan. 1977 56 p refs
(AD-A035250; BRL-1953) Avail: NTIS HC A04/MF A01 CSCL 19/4

All current gun interior ballistics computer programs rely on, and are sensitive to, the steady state burning rate 'law', r = ap to the n power. It is not clear that this is a valid representation in a highly transient pressure environment. To estimate possible dynamic effects, numerical solutions for three thermal-wave combustion models (KTSS, Levine/Culick, Kooker/Zinn) are obtained for a series of example cases where the imposed pressure variation at the edge of the flame zone is prescribed by an experimental pressure-time history from the 105mm Gun M68. The results obtained with several different numerical solution methods indicate that (1) at low pressure (early time) the instantaneous propellant burning rate can be much greater than ap to the n power; while at high pressure the burning rate returns asymptotically to ap to the n power, and (2) burning rate 'runaway' is a numerical difficulty and is not a solution to the combustion models. The effect of dynamic burning rate on closed-bomb measurements is estimated numerically with a simple model. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-25355 International Brotherhood of Electrical Workers, Washington, D. C.
REALITIES OF METRICATION: A REPORT
1977 39 p
(LC-77-74711) Copyright. Avail: Issuing Activity

A national policy on metrication based on realities is discussed in terms of the attitude of the AFL-CIO, and the Metric Conversion Act. World trade is used as a strong argument for conversion to the metric system. The economic effects of the conversion and the impact on workers are analyzed. F.O.S.

N77-25356# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
CRYOGENIC EQUIPMENT FOR A GRAVITATIONAL ANTENNA OF 20 kg [APPARECCHIATURA CRIOGENICA PER UN'ANTENNA GRAVITAZIONALE DA 20 kg]
S. Barbanera (CNR, Rome), C. Cosmelli (Rome Univ.), and U. Giovanardi Sep. 1976 22 p refs In ITALIAN
(LPS-76-23) Avail: NTIS HC A02/MF A01

The experimental cryogenic equipment is detailed for an aluminum gravitational wave antenna of 10 or 20 kg weight, using piezoelectric ceramics as vibration sensors, and refrigerated to liquid helium temperature. The sensitivity of this type of antenna is compared to the traditional types. ESA

N77-25357# California Univ., Los Angeles. School of Engineering and Applied Science.
MATHEMATICAL METHODS OF PROBABILISTIC SAFETY ANALYSIS
G. E. Apostolakis Sep. 1974 328 p refs
(Grant NSF GI-39416)
(PB-261873/4; UCLA-ENG-7464; NSF/RA/X-74-047) Avail: NTIS HC A15/MF A01 CSCL 18I

The objectives of this project include the following: (1) to make significant strides in the provision of improved bases or criteria for decision-making involving risk to the public health and safety (where a risk involves a combination of a hazard and the probability of that hazard); (2) to make significant strides in the structuring and development of improved, and possibly alternative, general methodologies for assessing risk and risk-benefit for technological systems; (3) to develop improvements in the techniques for the quantitative assessment of risk and benefit; (4) to apply methods of risk and risk-benefit assessment to specific applications in nuclear power (and possibly other technological systems) in order to test methodologies, to uncover needed improvements and gaps in technique, and to provide a partial, selective, independent assessment of the levels of risk arising from nuclear power. GRA

N77-25358# Naval Intelligence Support Center, Washington, D. C.
THE HYDRODYNAMICS OF THE HYDROFOIL
A. N. Panchenkov 27 Oct. 1976 556 p refs Transl. into ENGLISH from report by Inst. of Hydromechanics, Ukr. SSR, Academy of Science (USSR), 1965 539 p
(AD-A033049; NISC-Trans-3867) Avail: NTIS HC A24/MF A01 CSCL 20/4

The results of the investigation in the area of the hydrofoil theory are systematized in this monograph. A great deal of attention is given to the mechanical-mathematical aspects of the hydrofoil theory and to the development of the effective methods for solving the basic equations in the hydrofoil theory. This book considers the theory of steady motion of a wing with an arbitrary profile in a plane-parallel flow, the linear theory of thin hydrofoils in the two-dimensional and three-dimensional flows, the theory of a hydrofoil in an unsteady flow, and problems of the interaction of hydrofoils and motion of hydrofoils near the interface of fluids with different densities. GRA

N77-25359# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
PREDICTION OF ROLL, SWAY AND YAW MOTIONS OF HULLBORNE HYDROFOIL SHIPS
Rodney T. Schmitke Nov. 1976 79 p refs
(AD-A035997; DREA-TM-76/C) Avail: NTIS HC A05/MF A01 CSCL 13/10

To provide further capability for prediction and analysis of hydrofoil hullborne seakeeping, a mathematical model and computer program have been developed to predict roll, sway and yaw motions of hullborne hydrofoil ships in beam seas. Predictions agree well with towing tank data for a 1 20-scale model of the PHM hydrofoil craft. Author (GRA)

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N77-25360 British Library Lending Div., Boston Spa (England).
RECORDING SYSTEM FOR AUTOMATIC READING OF MORSE CODED DATA FROM RADIOSONDES
G. Dallaporta, A. Mazzoldi, and G. Peruzzo [1977] 20 p refs Transl. into ENGLISH from Riv. Met. Aero. (Rome), v. 35, 1975 p 121-128
(BLL-M-24845-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A system designed and constructed to study the dynamics of the large masses is described. The system is capable of receiving

and recording transmissions from a M 60 Graw radiosonde and transferring them to a digital tape recorder compatible with an IBM computer. The system can be used in carrying out programs of measurement when either fixed or mobile equipment is used, and is particularly useful when a large number of balloon soundings are involved as it avoids the need to use the traditional method of interpretation. The results obtained from a balloon sounding carried out in the area immediately surrounding the laboratory are also described in order to demonstrate the practicality of the system, especially as regards the interpretation of the data. Author

N77-25361 British Library Lending Div., Boston Spa (England).
QUADRATURE FILTERS WITH RATIONAL IMAGE TRANSFER FUNCTIONS
O. Herrmann Oct. 1976 19 p refs Transl. into ENGLISH from A. E. U. 23 Stuttgart, no. 2, 1969 p 77-84
(BLL-Trans-3397-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Methods normally used for the design of quadrature networks are surveyed and all pass transfer functions are described. Numerical results and diagrams are given for estimating the amount of required circuitry. An example shows the characteristics of the solutions and their differences from quadrature filters. Author

N77-25362 British Library Lending Div., Boston Spa (England).
PROPERTIES AND APPLICATIONS OF THIN METAL IN THE MICROWAVE RANGE
M. Schneider 29 Nov. 1976 77 p refs Transl. into ENGLISH from Tech. Mitt. PTT (Bern), v. 37, no. 11, Nov. 1959 p 465-495
(BLL-PO-Trans-3406-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Changes in properties due to the interaction of an electromagnetic field and a thin metallic film are studied. It is shown that several phenomena are particularly suitable for detecting and measuring microwave fields and that this can lead to the development of measuring techniques. The film coupler and the field detector are described. Author

N77-25363 British Library Lending Div., Boston Spa (England).
INFLUENCE OF ANTENNA RADIATION PATTERN ON ECHO TOP HEIGHT MEASUREMENTS: A COMPARISON FOR WEATHER RADARS AT TOKYO, NAGOYA AND NIIGATA
Fukushima S. Tokyo [1976] 11 p refs Transl. into ENGLISH from J. Meteorol. Res. (Japan), v. 26, 1974 p 467-470 In ENGLISH and JAPANESE
(BLL-M-24887-(5828.4F)) HC A02/MF A01

Antenna radiation pattern differences were investigated. Echo top height was measured by holding the antenna in position in the direction of the objective echo. The angle of elevation is raised at the precise point when the echo noise level and direction become nonexistant on the A scope. From this the vertical half beam width is substracted and the sea level height is sought from the height calculation diagram assuming a standard atmosphere. It is concluded that intense rainfall measured above a certain limit, Niigata has the highest echo top height derived from the model rain height, followed by Nagoya. Also, the echo top height is greater the stronger the rainfall intensity. B.B.

N77-25364 British Broadcasting Corp., Kingswood (England). Engineering Div.
CORRECTION OF PRIMARY CHROMATICITIES OF DISPLAY TUBES BY MATRIXING OF GAMMA-CORRECTED RGB SIGNALS
S. J. Lent, C. R. G. Reed, and R. Storey Apr. 1977 20 p refs
(BBC-RD-1977/17; PH-172) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Signal origination equipment produces signals which give optimum color fidelity using a given set of display primaries. These are the C.C.I.R. recommended primaries adopted for P.A.L. System I color television. The use of display primaries with incorrect chromaticities gives rise to color errors that can be unacceptable. Linear color-separation signals are not normally available in a picture monitor so simple matrix correction cannot theoretically be used. Matrixing of gamma-corrected signals can however provide a compromise solution. The color errors incurred by matrixing are discussed, and two methods of deriving a suitable matrix are described. Author

N77-25365 British Broadcasting Corp., Kingswood (England). Engineering Div.
CEEFAX: FIELD TRIALS AT VHF USING SYSTEM B-BAVARIA-APRIL 1975
M. G. Croll and D. T. Wright May 1977 35 p refs
(BBC-RD-1977/18; PH-171) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Tests were conducted to assess the suitability of the Teletex unified-standard parameters for use with the V.H.F. System B television standard. Field tests were conducted in Bavaria from the 16th to the 24th April, 1975 within the service area of the Wendelstein System B transmitter. In addition, information was provided about the performance of various television networks, transmitters, and transposers used in Germany. Overall, the tests demonstrated have shown that the Teletext parameters as specified in the unified standard specification are suitable for use with the V.H.F. television System B standard of transmission. Author

N77-25366 British Broadcasting Corp., Kingswood (England). Engineering Div.
BBC TEST CARD NO. 61 (FLESH TONE REFERENCE): COLORIMETRIC AND OTHER OPTICAL CONSIDERATIONS
E. W. Taylor and S. J Lent May 1977 7 p refs
(BBC-RD-1977/20; PH-175) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The colorimetric and optical characteristics of a new test card which provides an improved flesh tone reference are described. This test card consists of a printed reproduction, with excellent color fidelity, of a live model's face, produced by a modern offset lithograph process that can maintain a high standard of uniformity among a large number of copies. Special consideration is given to minimizing the effects of specularly reflected light from the surface of the chart. Author

N77-25367 British Broadcasting Corp., Kingswood (England). Engineering Div.
DIGITAL VIDEO: MULTIPLE SUB-NYQUIST CODING
J. H. Stott and G. J. Phillips Jun. 1977 23 p refs
(BBC-RD-1977/21; EL-127) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The effect of multiple digital coding of signals is considered, with particular emphasis on sub-Nyquist sampling. A theory is developed which shows that conditions exist whereby no extra degradation due to resampling occurs. Experimental work confirming these results is described, and the theory is extended to the use of mixed analog and digital transmissions, including allowance for practical links. Author

N77-25368 British Broadcasting Corp., Kingswood (England). Engineering Div.
AN AERIAL DIVERSITY SWITCH FOR THE CHANNEL ISLANDS TELEVISION RE-BROADCAST LINK
G. H. Millard and H. M. Price Jun. 1977 13 p refs
(BBC-RD-1977/22; RA-161) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

An experimental diversity switch is described which operates during the field blanking period of the television waveform. The switch is solid state and operates very rapidly to minimize the disturbance to the television waveform. The results of an experimental period of operation are given. Author

N77-25369*# ECON, Inc., Princeton, N.J.
THE PLAN FOR THE ECONOMIC EVALUATION OF THE PUBLIC SERVICE COMMUNICATION SATELLITE SYSTEM
Final Report
2 May 1977 64 p
(Contract NASw-3047)
(NASA-CR-153007; Rept-77-263-4) Avail: NTIS HC A04/MF A01 CSCL 17B

A plan for the economic evaluation of the Public Service Communications Satellite (PSCS) within domestic markets is presented. It extends through the planning, performance and

evaluation of economic experiments following the launch of the PSCS in 1982, and includes the consideration of how the results of these experiments impact the transfer from demonstration to operations. The implementation of this plan will provide information needed to understand and manage the economic and social impacts of the PSCS program. Author

N77-25370*# IIT Research Inst., Chicago, Ill. Techno/Economic Studies Group.
MARKET STUDY: TACTILE PAGING SYSTEM
20 May 1977 16 p
(Contract NASw-2837; IITRI Proj. H6046-H31)
(NASA-CR-153252) Avail: NTIS HC A02/MF A01 CSCL 17B

A market survey was conducted regarding the commercialization potential and key market factors relevant to a tactile paging system for deaf-blind people. The purpose of the tactile paging system is to communicate to the deaf-blind people in an institutional environment. The system consists of a main console and individual satellite wrist units. The console emits three signals by telemetry to the wrist com (receiving unit) which will measure approximately 2 x 4 x 3/4 inches and will be fastened to the wrist by a strap. The three vibration signals are fire alarm, time period indication, and a third signal which will alert the wearer of the wrist com to the fact that the pin on the top of the wrist is emitting a morse coded message. The Morse code message can be felt and recognized with the finger. Author

N77-25371*# Ohio State Univ., Columbus. ElectroScience Lab.
OSU PARTICIPATION IN THE CTS COMMUNICATIONS LINK CHARACTERIZATION EXPERIMENT Final Report, 2 Sep. 1975 - 31 Dec. 1976
D. B. Hodge and D. M. Theobold Dec. 1976 19 p refs
(Contract NAS5-22575)
(NASA-CR-152534; ESL-4299-2; FR-4299-2) Avail: NTIS HC A02/MF A01 CSCL 17B

A four element self phased array was developed for propagation measurements utilizing the Communication Technology Satellite 11.7 GHz downlink. The parameters of interest in measurements were attenuation, amplitude scintillation, and angle of arrival variability. Simultaneous scintillation measurements were also conducted at 360 MHz, 2.075 GHz, and 30 GHz utilizing ATS-6. The unique movement of ATS-6 during 1976 permitted extensive measurement of scintillation characteristics as a function of path elevation angle. Author

N77-25372*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR ANALYSIS OF COUPLED-CAVITY TRAVELING WAVE TUBES
Denis J. Connolly and Thomas A. Omalley Washington May 1977 53 p refs
(NASA-TN-D-8492; E-8839) Avail: NTIS HC A04/MF A01 CSCL 09C

A flexible, accurate, large signal computer program was developed for the design of coupled cavity traveling wave tubes. The program is written in FORTRAN IV for an IBM 360/67 time sharing system. The beam is described by a disk model and the slow wave structure by a sequence of cavities, or cells. The computational approach is arranged so that each cavity may have geometrical or electrical parameters different from those of its neighbors. This allows the program user to simulate a tube of almost arbitrary complexity. Input and output couplers, severs, complicated velocity tapers, and other features peculiar to one or a few cavities may be modeled by a correct choice of input data. The beam-wave interaction is handled by an approach in which the radio frequency fields are expanded in solutions to the transverse magnetic wave equation. All significant space harmonics are retained. The program was used to perform a design study of the traveling-wave tube developed for the Communications Technology Satellite. Good agreement was obtained between the predictions of the program and the measured performance of the flight tube. Author

N77-25373*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF FINITE SOURCE AND PLANE WAVE SCATTERING FROM CORRUGATED SURFACES
David M. LeVine Apr. 1977 34 p refs Submitted for publication
(NASA-TM-X-71329; X-953-77-111) Avail: NTIS HC A03/MF A01 CSCL 20N

The choice of a plane wave to represent incident radiation in the analysis of scatter from corrugated surfaces was examined. The physical optics solution obtained for the scattered fields due to an incident plane wave was compared with the solution obtained when the incident radiation is produced by a source of finite size and finite distance from the surface. The two solutions are equivalent if the observer is in the far field of the scatterer and the distance from observer to scatterer is large compared to the radius of curvature at the scatter points, condition not easily satisfied with extended scatterers such as rough surfaces. In general, the two solutions have essential differences such as in the location of the scatter points and the dependence of the scattered fields on the surface properties. The implication of these differences to the definition of a meaningful radar cross section was examined. Author

N77-25374# Institut Franco-Allemand de Recherches, St. Louis (France).
RADIATION OF AN ANTENNA IN A COLD PLASMA. CALCULATION OF THE PERTURBATION AND APPROXIMATION DETERMINATION OF THE RADIATION FIELD [RAYONNEMENT D'UNE ANTENNE DANS UN PLASMA FROID. CALCUL DE LA PERTURBATION ET DETERMINATION APPROCHEE DU CHAMP]
E. Argence 30 May 1974 47 p refs In FRENCH
(ISL-41/74) Avail: NTIS HC A03/MF A01

The differential equation for calculation of the electric antenna radiation field of an antenna radiating in a cold plasma was drawn up. The electric field is isotropic and radiatés near plasma resonance. Certain solutions are elaborated. ESA

N77-25375# Fondazione Ugo Bordoni, Rome (Italy).
ATTENUATION AND DEPOLARIZATION IN TROPOSPHERIC PROPAGATION AT FREQUENCIES ABOVE 10 GHz [ATTENUAZIONE E DEPOLARIZZAZIONE NELLA PROPAGAZIONE TROPOSFERICA A FREQUENZE SUPERIORI A 10 GHz]
Dario Maggiori 14 Feb. 1976 50 p refs In ITALIAN
Avail: NTIS HC A03/MF A01

A rain precipitation model is discussed; its effect on the propagation of an electromagnetic wave above 10 GHz was studied. Attenuation coefficients and phase shift were determined electromagnetically for rectilinearly polarized EM waves, taking into account raindrop size and a flat layer of rain precipitation. The results were applied to the model. The attenuation and discrimination relations were calculated for horizontally and vertically cross polarized signals. ESA

N77-25376# Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.
COMPLEX DIELECTRIC CONSTANT MEASUREMENT IN THE FIELD OF MILLIMETER WAVES [MISURA DELLA COSTANTE DIELETTRICA COMPLESSA NEL CAMPO DELLE ONDE MILLIMETRICHE]
Franco Bertolani, Giulio Cattani, and Sergio Rogai 24 May 1976 17 p refs In ITALIAN
Avail: NTIS HC A02/MF A01

A new resonance method for measuring the dielectric constant of materials used in circular waveguides is described. The method is based on evaluation of the resonant frequency variations and the quality factor of a waveguide cavity after insertion of a sample of dielectric material. The performance of a test bench was verified in the range 40 to 60 GHz for a polyethylene sample. The dielectric constant and loss angle measured are in good agreement with theoretical calculations. ESA

N77-25377# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.
DETERMINATION OF FORMANT DATA FROM THE TRANSIENT POWER SPECTRA OF SPEECH SIGNALS [BESTIMMUNG VON FORMANTDATEN AUS DEN KURZZEIT-LEISTUNGSSPEKTREN VON SPRACHSIGNALEN]
Ruediger Reiss Aug. 1976 26 p refs In GERMAN

(IND-FB-95) Avail: NTIS HC A03/MF A01

A method is proposed for determination of the formant data: formant frequency, formant bandwidth, and formant amplitude, from the transient power spectra of speech signals. The problem consists essentially in the selection of the spectral maxima significant to the weakly damped resonances of the voice forming system. This significance is obtained by averaging over consecutive spectra of overlapping time segments. Based on these highly significant spectra, the problem of formant data determination consists in the solution of a low degree linear equation system for each formant. ESA

N77-25378# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.

MODAL FREQUENCY AND RANDOM RESPONSE OF THE AIRBUS A300B ANTENNA

Heinrich Goedel and Franz Weiss 27 Apr. 1976 14 p refs Presented at the NASTRAN European User's Conf., Munich, 5-6 May 1976

(UFE-1242-0) Avail: NTIS HC A02/MF A01

Using the NASTRAN program system a computation of vibration and response was carried out for the ADF (Automatic Direction Finder) of the Airbus A300B in order to estimate the stress level within the scope of service life considerations. Using RIGID FORMAT 3 for normal mode computations and RIGID FORMAT 11 for power spectral density analysis, it was possible to achieve the actually obtained results for frequency responses in a simple way by means of the NASTRAN system. A boundary layer spectrum confirmed by measurements was introduced as a power spectrum into the computation. The pressure distribution on the shell plane was assumed constant and symmetrical. Due to this assumption, which has been proved realistic, only symmetrical modes had to be considered for dynamic response investigations. The modal procedure utilized a number of 20 symmetrical normal modes covering a frequency range of about 600 Hz. The frequency response is essentially determined by two modes causing an almost constant deformation of cross sections in the longitudinal direction. The maximum rms value of the encountered stresses is 5.6 kp/sq m. The exceedance number for this stress value is 8.2 x 10 to the 9th power during the service life. It was proved by calculations that the fatigue life of the antenna structure is considerably higher than the service life of the airplane. Author (ESA)

N77-25379# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.

[RESEARCH ACTIVITIES OF THE RADIO LABORATORY] Annual Report, 1974 - 1975

Martti Tiuri 1976 31 p refs

(Rept-S-87; ISBN-951-750-714-3) Avail: NTIS HC A03/MF A01

Activities in the following fields are presented: electromagnetic theory, waves and antennas; circuit theory and computer-aided design; microwave theory and techniques; microwave applications; radio science and instrumentation; and laser applications. ESA

N77-25380# Syracuse Univ., N. Y.

POINT SOURCE REPRESENTATION OF ANTENNAS AND OBSTACLES

Jose Perini and Jason Chou Griffiss AFB, N. Y. RADC Jan. 1977 33 p refs

(Contract F30602-75-C-0121)

(AD-A036091; RADC-TR-77-34) Avail: NTIS HC A03/MF A01 CSCL 09/5

In this report the behavior of the current on a parasite wire as a function of the distance d from the driven wire has been investigated for d in the range from .1 lambda to 2 lambda. The mutual coupling presented by adjacent parasite wires has been taken into account. The result shows that the parasite wire current magnitude and phase can be predicted by a simple relation. Author (GRA)

N77-25381# Institute for Telecommunication Sciences, Boulder, Colo. Inst. for Telecommunication Sciences.

AN APPROXIMATE METHOD FOR CALCULATING THE PERFORMANCE OF CPSK AND NCFSK MODEMS IN GAUSSIAN NOISE AND INTERFERENCE

John R. Juroshek Jan. 1977 28 p refs

(PB-264131/4; OTR-77-109) Avail: NTIS HC A03/MF A01 CSCL 17B

A simplified method was developed for estimating the performance of coherent phase shift keyed (CPSK) and noncoherent frequency shift keyed systems in interference. The method is based on the eye diagram bound and provides an upper bound estimate of the probability of a bit error given the signal to noise ratio and signal to interference ratio. Application of the bound is demonstrated both for constant amplitude, circularly symmetric interference, and amplitude-varying interference. With amplitude-varying interference, the bound requires a knowledge of the ratio of peak signal power to peak interference. The accuracy of the bound is demonstrated by comparing the bound to other predictions obtained by more exact mathematical analyses. The extension of the bound to multiphase CPSK is also described. It is anticipated that this bound will be useful primarily in studies that require a simple method of estimating degradation from interference, and where the errors due to the looseness of the bound are acceptable. GRA

N77-25382# Institute for Telecommunication Sciences, Boulder, Colo. Inst. for Telecommunication Sciences.

AN AUTOMATED TECHNIQUE FOR CALCULATING INTERFERENCE FROM AIRBORNE TRANSMITTERS TO TERRESTRIAL RECEIVERS

John K. Wheeler and Eldon J. Haakinson Feb. 1977 82 p refs

(PB-264519/0; OTR-77-110) Avail: NTIS HC A05/MF A01 CSCL 17B

A computer program (ATTIC) was developed with the ability to automatically compute and plot interference contours around existing microwave systems when new airborne systems are proposed or planned. The frequency manager or spectrum analyst can utilize ATTIC to vary the airborne system parameters and examine the size of the interference contours. The ATTIC program implements a procedure for determining the level of interference generated in a terrestrial microwave terminal (or system of microwave terminals) by an airborne telecommunication system. The output of this procedure is a set of contours defining those aircraft positions which produce a constant signal to interference (S/I) ratio to the terrestrial systems being analyzed. The S/I contours are plotted on a map with U.S. state boundaries. The user supplies the basic aircraft data while the terrestrial receiver(s) data are obtained from a computer accessible data base. Although program flow and program limitations are discussed, emphasis is on implementing ATTIC, interpreting the output, and presenting sample analyses. GRA

N77-25383# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN EXPERIMENTAL INVESTIGATION OF THE RESONANT MODES OF A ROOFTOP LASER M.S. Thesis

Ronald L. Grotbeck Dec. 1976 139 p refs

(AD-A034006; GEP/PH/76-4) Avail: NTIS HC A07/MF A01 CSCL 20/5

First-surface roof-reflectors were constructed with apex angles near 90 deg and used as resonator elements in a 2-meter laser cavity with a gain medium of electrically excited CO2, N2, and He at 10 torr pressure. The divergence, far-field intensity distribution, and beat frequency components were measured for the output beams of several roof-resonator configurations. Both single-mode and multi-mode operation was achieved, and the mode structure of the several alignment-insensitive configurations was inferred. Author (GRA)

N77-25384# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.

YAGI ANTENNA DESIGN Final Report

Peter P. Viezbicke Dec. 1976 30 p refs

(PB-262885/7; NBS-TN-688) Avail: NTIS HC A03/MF A01 CSCL 09E

Data using modeling techniques for the optimum design of different length Yagi antennas were presented. The information is in graphical form to facilitate the design of practical length antennas from 0.2 wavelength to 4.2 wavelengths long for operation in the HF, VHF, and UHF frequency range. The effects of different antenna parameters on realizable gain were also investigated and the results are presented. Finally, supplemental

data are presented on the stacking of two or more antennas to provide additional gain. GRA

N77-25385*# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.

MODULATION STUDIES FOR DIRECT SATELLITE COMMUNICATION OF VOICE SIGNALS

Hiroshi Akima Dec. 1976 60 p refs Sponsored in part by NASA

(NASA-CR-153246; PB-263888/0; OTR-76-108) Avail: NTIS HC A04/MF A01 CSCL 17B

The question of modulation in the direct communication of voice signals from a satellite to individual homes for warning of natural disasters was investigated. A reasonable voice quality required at the final destination was determined, and the required radio frequency signal power at the receiver input was estimated. Based on this result and the available UHF signal power measurement result, the system margin in the power budget was evaluated for certain system parameter values. Potential use of an existing home radio and television receiver as a part of the system was considered. The possibility of such a use appears to be remote. GRA

N77-25386# Illinois Univ., Urbana-Champaign. Electromagnetics Lab.

SPECTRAL ANALYSIS OF HIGH-FREQUENCY DIFFRACTION OF AN ARBITRARY INCIDENT FIELD BY A HALF-PLANE-COMPARISON WITH FOUR ASYMPTOTIC TECHNIQUES

Y. Rahmat-Samii and R. Mittra Nov. 1976 96 p refs

(Grant NSF ENG-76-08305)

(PB-262379/1; UILU-ENG-76-2560; EM-76-10) Avail: NTIS HC A05/MF A01 CSCL 20N

The problem of a halfplane illuminated by a nonplanar wave is investigated using the concept of the plane were spectral representation. For large wave number k, a new higher-order asymptotic solution for the total field up to and including terms of order k to the minus 5/2 power relative to the incident field is derived. The behavior of the solution for the observation points which coincide with shadow boundary directions of a multipole line source is discussed in detail. Furthermore, numerical solution of the field integral representation is constructed for the observation angles in the transition regions. The results are compared with those of the Geometrical Theory of Diffraction, the Uniform Asymptotic Theory, the Uniform Theory of Diffraction and the Modified Slope Diffraction. GRA

N77-25387# Federal Communications Commission, Washington, D. C. Research and Standards Div.

POWER DENSITY IN NEAR FIELD OF SMALL LINEAR ANTENNAS

John C. H. Wang Dec. 1976 15 p refs

(PB-262930/1; FCC/OCE/RSTM-76-01) Avail: NTIS HC A02/MF A01 CSCL 09E

Equations are derived for the time average power density in the near and far fields of a small linear antenna, and an expression is developed for the maximum possible power density in the near field. Theoretical results are compared with measurements made on a walkie talkie and the differences are analyzed. GRA

N77-25388# Harry Diamond Labs., Adelphi, Md.

A NUMERICAL STUDY OF AN IDEALIZED EMP PROBLEM

J. Michael Clodfelter Dec. 1976 58 p refs

(DA Proj. 1W1-62118-AH-75; HDL Proj. X755E3)

(AD-A035272; HDL-TR-1783) Avail: NTIS HC A04/MF A01 CSCL 18/6

Accurate results were obtained for the time history of the electric-field strength between two parallel, infinite, aluminum plates caused by Compton electrons generated by a transient, high-intensity, gamma-ray flux. Two numerical methods, Hamming's method and an exponential differencing technique, were used to solve the resulting ordinary differential equations of the problem. The two techniques and their results are examined and compared, and it is set forth that the exponential differencing method provides a more efficient solution to the ordinary differential equations of the type involved in this problem. Author (GRA)

N77-25389# California Univ., Los Angeles. School of Engineering and Applied Science.

SOURCE CODING AND ADAPTIVE DATA COMPRESSION FOR COMMUNICATION NETWORKS

Howard S. Nussbaum and Izhak Rubin Dec. 1976 221 p refs Sponsored in part by Hughes Aircraft Co.

(Contract N00014-75-C-0609; Grant NSF ENG-75-03224; NR Proj. 042-291)

(AD-A035222; UCLA-ENG-76121) Avail: NTIS HC A10/MF A01 CSCL 17/2

Coding under a fidelity criteria of a class of sources which emit randomly occurring messages is investigated. This class of sources models information carrying processes entering into communication networks. Messages emitted by computer terminals, teletypes, vocoders, and other such devices serve as actual examples. For this class of sources the rate distortion function is derived, and source coding and converse source coding theorems are proven. Employing these theorems, an operational definition of the rate distortion function in terms of message queueing delay and transmission delay is presented. This definition relates the rate distortion function with the message network delay which is an important measure of performance of a communication network. Also, for such a class of sources, which emit randomly occurring messages, an adaptive data compression scheme is investigated. This scheme utilizes observations of the network congestion to determine the amount of compression a message receives, with the object of minimizing the message delay for a given distortion level. GRA

N77-25390# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

ENVIRONMENT AND RADAR OPERATION SIMULATOR Quarterly Report, 1 Jan. - 31 Mar. 1976

S. N. Cole and E. R. Flynt Jun. 1976 27 p refs

(Contract DAAB07-74-C-0272; DA Proj. 1S7-62703-DH-93)

(AD-A035221; ECOM-74-0272-7; QR-7) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report summarizes activities during the seventh quarter of a program sponsored by the U.S. Army Electronics Command (ECOM), directed toward the design of an Environment and Radar Operation Simulator (EROS). In addition some of the analysis results and design decisions are described in detail. A computer simulation of the shift-register random-number generator has been performed to verify its autocorrelation properties. The implementation decision with regard to radar cross section scaling is presented as a formula, and the techniques for applying this formula to target and clutter signals are discussed. In previously reported design plans the range weighting and integration, functions were to be performed by digital hardware. It has been determined that there are a number of advantages to performing these functions in analog hardware, and the design plan has been modified accordingly. Author (GRA)

N77-25391# Naval Research Lab., Washington, D. C.

AN IMPROVED ALGORITHM FOR ADAPTIVE PROCESSING

Frank F. Kretschmer, Jr. and Bernard L. Lewis 17 Dec. 1976 14 p refs

(NRL Proj. R12-07; SF1214141)

(AD-A035140; NRL-8084) Avail: NTIS HC A02/MF A01 CSCL 17/9

The Widrow least mean square algorithm based on the method of steepest descent tends toward instability. An improved algorithm is given which is unconditionally stable and provides better cancellation performance in adaptive-array or adaptive-filter applications. The method is applied to processing of radar signals. GRA

N77-25392# Rome Air Development Center, Griffiss AFB, N.Y.

AN ARRAY TECHNIQUE FOR ZENITH TO HORIZON COVERAGE

William G. Mavroides and Robert J. Mailloux Nov. 1976 24 p refs

(AF Proj. 4600)

(AD-A035503; RADC-TR-76-360) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report describes a new concept in wide-angle coverage arrays and has application to the problem of providing low-cost

efficient antennas with hemispherical coverage for aircraft-to-satellite communication links. The combined array surface-wave antenna consists of 64 waveguide elements conventionally scanned, except at endfire. At endfire the array is shorted to become a corrugated surface-wave antenna and is excited by an 8-element feed to provide a directional beam near the horizon. The array is rotated to give hemispherical coverage. GRA

N77-25393# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

THE HARPY SPEECH RECOGNITION SYSTEM Ph.D. Thesis

Bruce T. Lowerre Apr. 1976 125 p refs

(Contract F44620-73-C-0074; ARPA Order 2466)

(AD-A035146; AFOSR-76-0021TR) Avail: NTIS HC A06/MF A01 CSCL 17/2

The Harpy connected speech recognition system is the result of an attempt to understand the relative importance of various design choices of two earlier speech recognition systems developed at Carnegie-Mellon University: The Hearsay-1 system and the Dragon system. Knowledge is represented in the Hearsay-1 system as procedures and in the Dragon system as a Markov network with a-priori transition probabilities between states. Systematic performance analysis of various design choices of these two systems resulted in the HARPY system, in which knowledge is represented as a finite state transition network but without the a-priori transition probabilities. Harpy searches only a few 'best' syntactic (and acoustic) paths in parallel to determine the optimal path, and uses segmentation to effectively reduce the utterance length, thereby reducing the number of state probability updates that must be done. Several new heuristics have been added to the HARPY system to improve its performance and speed: detection of common sub-nets and collapsing them to reduce overall network size and complexity, eliminating the need for doing an acoustic match for all phonemic types at every time sample, and semi-automatic techniques for learning the lexical representations (that are needed for a steady-state system of this type) and the phonemic templates from training data, thus automatically accounting for the commonly occurring intra-word coarticulation and juncture phenomena. Inter-word phenomena are handled by the use of juncture rules which are applied at network generation time, thereby eliminating the need for repetitive and time consuming application of phonological rules during the recognition phase. GRA

N77-25394# Syracuse Univ., N. Y.

GAIN AND DISTORTION MONITOR FOR GROUND-AIR-GROUND COMMUNICATION PERFORMANCE MONITORING

Jose Perini and Richard Bantel Jan. 1977 33 p refs

(Contract F30602-75-C-0121)

(AD-A036087; RADC-TR-77-21) Avail: NTIS HC A03/MF A01 CSCL 17/2

Ground-air-ground communications are used world wide to control aircraft traffic and require the interconnections of multiple transmitters, receivers, recorders, microphones, antennae, etc. In such complex systems it is highly desirable to have some means of measuring the overall system performance with one simple test so that performance degradation can be constantly monitored. After some experimentation, it was decided that a measurement of the system distortion to a 500 Hz tone was a suitable parameter. It is also important to measure the system overall gain so that the operators can be alerted to any drastic change in levels throughout the system. The equipment described in this report was designed specifically to perform both of these measurements. Author (GRA)

N77-25395# Network Analysis Corp., Glen Cove, N. Y.

INTEGRATED DOD VOICE AND DATA NETWORKS AND GROUND PACKET RADIO TECHNOLOGY Semiannual Technical Report

Howard Frank and Israel Gitman Aug. 1976 198 p refs

(Contract DAHC-15-73-C-0135; ARPA Order 2286)

(AD-A036160; SATR-7) Avail: NTIS HC A09/MF A01 CSCL 17/2

New research results on the following major questions are reported: Methodology and algorithms for mixed terrestrial-satellite network design are developed. Simple cost functions for mixed network design are proposed and demonstrated to be good estimates. The algorithms are applied to AUTODIN 2 data, and sensitivity to variations in cost, traffic level, and other design parameters are presented. A procedure for minimum cost design and for analysis of nonhierarchical circuit switched networks is presented. The problem of connectivity in mobile packet radio networks is solved and implications for predictable networks outlined. Approximate analytical models for initialization of packet radio networks are presented, initialization time is estimated, and operating parameters to obtain minimum initialization time are derived. Author (GRA)

N77-25396# Lincoln Lab., Mass. Inst. of Tech., Lexington.

AUTOMATIC REPORTING OF HEIGHT (AROH) DESIGN AND TRADE-OFF STUDIES

Lincoln Cartledge, Melvin Labitt, and Chi-Sun Lin 1 Nov. 1976 67 p refs

(Contract F19628-76-C-0602)

(AD-A035316; TN-1976-42; ESD-TR-76-3) Avail: NTIS HC A04/MF A01 CSCL 17/9

Application of MTD signal processing and state-of-the-art data processing can result in a completely automatic nodding beam height finder. The resultant savings in manpower are significant. Calculations show that such a system should have good sensitivity and adequate rejection of ground and weather clutter. Modification of an FPS-6 radar for this purpose is discussed. Author (GRA)

N77-25397# Northwestern Univ., Evanston, Ill. Dept. of Electrical Engineering.

ON UNIQUELY DECIPHERABLE CODES WITH GIVEN COMPOSITIONS Interim Report

S. C. Ntafos and S. L. Hakimi 1976 11 p refs Presented at the 1976 Allerton Conf. on Circuit and System Theory

(Grant AF-AFOSR-3017-76; AF Proj. 2304)

(AD-A035356; AFOSR-77-0026TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

It has been conjectured that a uniquely decipherable (U.D.) code can be replaced by a prefix code with the same codeword compositions. The conjecture is proved for the two length case, that is for U.D. codes with codeword lengths from the set (l sub 1, l sub 2). This result is then extended to a more general class of U.D. codes, and an equivalent conjecture is proposed for the general case. Author (GRA)

N77-25398# University of Southern Calif., Los Angeles. Image Processing Inst.

INTERFRAME CODING OF DIGITAL IMAGES USING TRANSFORM AND HYBRID TRANSFORM/PREDICTIVE TECHNIQUES Ph.D. Thesis

John A. Roese San Diego, Calif. NUC Jun. 1976 133 p refs

(Contract F33615-76-C-1203; ARPA Order 2303; ARPA Order 3119)

(AD-A035083; USCIPI-700; NUC-TP-534) Avail: NTIS HC A07/MF A01 CSCL 09/4

In the design of digital image coding systems, the principal objective is to achieve high quality receiver image reconstructions with a minimum number of transmitted code bits. Bit rate reductions are achieved by exploiting statistical redundancies within an image. This is combined by transmission of only those portions of the mathematical image representation to which the human observer is most sensitive. This dissertation describes research intended to extend current image coding techniques to the coding of sequences of digital images transmitted over a digital communications channel. The emphasis is directed towards definition of an image coding system that exploits temporal as well as spatial image redundancies. A primary objective of this investigation is to develop a class of interframe hybrid transform/predictive coders having near optimum levels of performance. The interframe hybrid coder implementations considered employ two-dimensional unitary transforms in the spatial domain, coupled with first-order DPCM predictive coding in the temporal domain. Based on a statistical image representation, a model is developed for the hybrid coder transform coefficient temporal difference variance matrix. With this model, theoretical MSE performance levels for the hybrid coder with zonal coding are determined as a function of spatial subblock size. Implementa-

tions of the interframe hybrid coder using discrete cosine and Fourier transforms are experimentally evaluated. GRA

N77-25399# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.

QUASI-COHERENT DETECTOR PERFORMANCE WITH APPLICATION TO CW RADAR

Thomas H. Gee and Robert R. Boothe 1 Oct. 1976 52 p refs

(DA Proj. 1W3-62303-A-214)

(AD-A035050; RE-77-1) Avail: NTIS HC A04/MF A01 CSCL 17/9

The evolution of a quasi-coherent detector having application to CW Radar is presented. The detector is configured as paralleled correlator channels which use digital techniques to process video signals. Doppler frequency channels and channels representing the initial phase of the received signal, or return, are employed to approximate a coherent detector. A distinguishing feature of the quasi-coherent detector lies in the use of a rectangular pulse train as the local signal which is correlated with the return. The rectangular pulse structure provides computational efficiency, while being optimized with respect to signal-to-noise ratio. Analytical results of particular interest pertain to the comparative performance of the quasi-coherent detector and the optimum coherent detector, the latter providing a detection performance benchmark. In the absence of errors in estimation of Doppler frequency and initial phase, it is shown that the detector performs about 0.35 db inferior to optimum. With limitations of a finite number of processor channels, trade-offs between implementation complexity and performance in the presence of estimation errors are discussed. Criteria for design of the quasi-coherent detector are presented. Author (GRA)

N77-25400# Colorado Univ., Boulder. Electromagnetics Lab.

SOME COMMENTS ON THE TIME-CAUSAL CHARACTERISTICS OF LEAKY AND SURFACE WAVES Interim Report

Leonard Lewin Griffiss AFB, N. Y. RADC Dec. 1976 22 p refs

(Contract F19628-76-C-0099)

(AD-A035053; RADC-TR-76-374; TR-2) Avail: NTIS HC A02/MF A01 CSCL 09/4

The generation of surface waves on an infinite cylindrical antenna by a point source is examined, and the amplitude of the leaky-wave or the Goubau-wave, depending on the reactive surface loading, is determined. A Fourier-time analysis then gives the surface-wave transient, and in both cases it is found to take the form of a precursor outside the light cone. It is concluded that both these surface waves are non-causal in character, and that this property is likely to be a general one for isolated modes that individually do not satisfy the radiation condition. Author (GRA)

N77-25401# Colorado Univ., Boulder. Electromagnetics Lab.

ON THE VALIDITY OF THE THIN WIRE APPROXIMATION IN ANALYSIS OF WAVE PROPAGATION ALONG A WIRE OVER A GROUND Interim Report

R. J. Pogorzelski and David C. Chang Griffiss AFB, N. Y. RADC Dec. 1976 29 p refs

(Contract F19628-76-C-0099)

(AD-A035054; RADC-TR-76-373; TR-3) Avail: NTIS HC A03/MF A01 CSCL 20/3

An analysis of the propagation of electromagnetic waves along a perfectly conducting wire parallel to a plane interface between dissimilar materials is presented. Particular emphasis is placed on determination of the significance of the first order Fourier components of current on the wire compared with the zero order current which has no azimuthal dependence around the wire. Author (GRA)

N77-25402# Alabama Univ., Huntsville.

A REVIEW OF PULSE COMPRESSION SIGNALS FOR TRACKING APPLICATIONS, VOLUME 1 Final Report, Jun. - Nov. 1976

Robert J. Polge and B. K. Bhagavan Nov. 1976 86 p refs

(Contract DAAH01-76-C-0991)

(AD-A035781; UAH-RR-196) Avail: NTIS HC A05/MF A01 CSCL 17/9

This report reviews pulse compression signals and their applicability to tracking radars. The emphasis is on binary phase coded signals, such as Barker codes and linear maximal length sequences. The properties of complementary sequences are reviewed and techniques for utilizing these sequences in tracking radars are discussed. Linear frequency modulated signals, polyphase codes and signals with simultaneous amplitude and phase modulation are also considered. Author (GRA)

N77-25403# Ohio State Univ., Columbus. ElectroScience Lab.

AN ADAPTIVE ARRAY TECHNIQUE FOR AM SIGNALS Quarterly Report, 1 Jul. - 30 Sep. 1976

L. C. Chan and R. T. Compton, Jr. Jan. 1977 42 p refs

(Contract N00019-76-C-0195)

(AD-A035780; ESL-4326-3) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report discusses a method of using an adaptive array with AM signals. A technique is suggested in which phase modulation is added to a conventional AM signal to make it possible to separate the desired signal from interference. The new signal will be transmitted in the same bandwidth as the conventional AM signal and hence can be intermixed with standard signals in a communication net. Digital simulations of such a system have been done and a few of the results are shown in this report. These results indicate that the array will provide suitable interference protection with such signals. Author (GRA)

N77-25404# Regis Coll., Weston, Mass.

SPECIFICATION OF RADAR ERROR FOR ADCOM RADARS WITH ADAPTIVE MODELING Interim Scientific Report, 1 Jul. - 20 Sep. 1976

Delia D. Dulong and Richard S. Allen 20 Sep. 1976 26 p

(Contract F19628-76-C-0255)

(AD-A035803; SR-1; AFGL-TR-76-0037) Avail: NTIS HC A02/MF A01 CSCL 17/9

Examination of the space and time variability of the expected ionospheric range error at ADCOM radars suggests that the day to day variability may be reduced using an adaptive modeling technique. A model of the range error correction for the entire field of view is specified by range error measurements along the path of a TRANSIT satellite and/or along the path to any synchronous beacon satellite. For targets in the upper ionosphere the residual range error from the day to day variability with respect to the monthly median may be reduced by a factor of 4 to 10. For targets at F-region heights the improvement may be only a factor of 2 if the height and thickness parameters are not also specified. GRA

N77-25405# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.

A SOLUTION FOR A WIDE APERTURE REACTIVELY LOADED ANTENNA ARRAY

John Luzwick Jan. 1977 32 p refs

(Contract N00014-76-C-0225)

(AD-A035902; TR-77-1; TR-5) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report considers an array of wide aperture reactively loaded antennas, specifically, an N element array of closely-spaced waveguide-backed rectangular slots radiating into a half-space, region. Only the center slot is fed and the other slots are parasitically excited. The parasitic slots are reactively loaded by short-circuit waveguides. By varying the positions of the short circuits, a directive beam can be steered through 180 deg in space. The solution uses the moment method applied to the integral equation for the equivalent magnetic current in the aperture region and a numerical integration technique. Solutions for seven, nine, and fifteen element aperture arrays are given. A computer subroutine which generates the aperture halfspace admittance matrix is described and listed. Author (GRA)

N77-25406# Naval Postgraduate School, Monterey, Calif.

DECK BOXES FOR UHF SATCOM RADIO

G. B. Parker and John E. Ohlman Oct. 1976 59 p refs

(AD-A035808; NPS-62OL76105) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report concerns itself with the design, construction, and utilization of a remotely controlled deck box assembly. This deck

box assembly was used in conjunction with other specialized equipments for the study of radio frequency interference. This study, 'Shipboard RFI in UHF STACON,' was sponsored by the Naval Electronics System Command and concerns itself with the electromagnetic spectrum and potential RFI in the 240 to 400 MHz band. These deck boxes incorporate fixed and tunable bandpass filters, tunable notch filters, remotely controlled coaxial switches, and amplifier, attenuator, and noise diode in an RF protected enclosure. Details include design criteria, component selection, circuit construction, physical layout, control circuitry and technical support for the deck box assembly. Author (GRA)

N77-25407# Naval Postgraduate School, Monterey, Calif.
A HIGH LEVEL NOISE BLANKER AND RF AMPLIFIER SYSTEM FOR THE JHF BAND
Frederick Earl Mace, Jr. and John E. Ohlson Oct. 1976 111 p refs
(AD-A035809; NPS-62OL76106) Avail: NTIS HC A06/MF A01 CSCL 20/14

The design and construction of a high level noise blanker and RF amplifier system as used in RFI measurement work is presented. This RFI work is part of the Shipboard RFI in UHF STACOM project sponsored by Naval Electronic Systems Command. The system requirements are discussed providing a basis for deriving the system specifications. The design of the solid state blanker is presented in detail, along with tests performed on the completed system. Electromagnetic compatibility of the unit with the working environment is considered in the design and in the special construction techniques employed.
Author (GRA)

N77-25408# Naval Postgraduate School, Monterey, Calif.
A LEVEL DENSITY ANALYZER FOR SHIPBOARD RFI MEASUREMENTS
Dennis Calvin Arneson and John F. Ohlson Oct. 1976 87 p refs
(AD-A035810; NPS-62OL76107) Avail: NTIS HC A04/MF A01 CSCL 20/14

The design and construction of a level density analyzer for use in the measurement of shipboard radio frequency interference consisted of integrating various analog and digital integrated circuits and related electronic components to enable accurate level analysis of a broad range of analog signals including noise and/or electromagnetic waves which constitute radio frequency interference. The overall design and system goals were to be able to adequately sample an analog signal, classify it, convert the classification to digital data and provide outputs to be logged either by manual or magnetic tape means. The design and construction efforts efficiently and economically achieved these goals. Author (GRA)

N77-25409# Raytheon Co., Sudbury, Mass. Equipment Div.
SLANT RANGE VISIBILITY MEASURING LIDAR Final Report, Jul. 1974 - Sep. 1976
Ralph G. McManus, Arthur A. Chabot, Robert M. Young, and Leonard R. Novick Sep. 1976 85 p refs
(Contract F19628-75-C-0021; AF Proj. 6670)
(AD-A035480; ER76-4355; AFGL-TR-76-0262) Avail: NTIS HC A05/MF A01 CSCL 20/5

This design report presents the results of efforts to establish equipment parameters required for a single-ended transmissometer system to measure the visibility along a slant range such as that corresponding to the line of sight of a pilot in an aircraft approaching an airport runway. Author (GRA)

N77-25410# Stanford Research Inst., Menlo Park, Calif.
MIC 7-TO-11-GHz FREQUENCY DISCRIMINATOR Final Report, 25 Mar. 1975 - 31 Jul. 1976
Ulrich H. Gysel and John P. Watjen Sep. 1976 102 p refs
(Contract N00039-75-C-0404; SRI Proj. 4237)
(AD-A034977) Avail: NTIS HC A06/MF A01 CSCL 09/5

A broadband (7 to 11 GHz) frequency discriminator was developed that is highly linear and suitable for either CW or pulse RF input signals. Microwave integrated circuit (MIC) techniques were used in the construction of the discriminator. Microstrip is chosen for the RF circuits to minimize the discriminator's size and, eventually, cost of production. The discriminator is of the conventional line discriminator type and consists of two 3-db quadrature hybrids, a delay line, and two detectors. The difference between the two detector outputs is the desired output voltage, which is close to a linear function of the incoming signal. Interaction between imperfect subcomponents and higher harmonics that are generated in the detector diodes causes undesirable ripples in the frequency-response characteristic. A computer analysis program was written to determine error sources and to develop subcomponent specifications that must be maintained to obtain a given linearity specification. The development of high-performance microstrip quadrature hybrids, 3-db attenuators, terminations, and detectors is described. GRA

N77-25411# Naval Postgraduate School, Monterey, Calif.
IMPEDANCE MEASUREMENT OF THE CROSSED-MONOPOLE WIRE STRUCTURES M.S. Thesis. Final Report, 29 Mar. - 15 Dec. 1976
David G. Rundall Dec. 1976 122 p refs
(AD-A036183; NPS-62ZN76122) Avail: NTIS HC A06/MF A01 CSCL 09/5

This investigation experimentally determines the input impedance characteristics of various cylindrical crossed-monopole antennas at 2-12 GHz frequencies and compares the results to the well known characteristics of the cylindrical monopole antenna. The analysis includes a physical reasoning for the loading effect of the arm on the cross-monopole antenna and resonance effects contributed by various members. The experimental results are also compared to the results obtained using numerical analysis.
Author (GRA)

N77-25412# Ohio State Univ., Columbus. ElectroScience Lab.
A MODEM/CONTROLLER FOR TDMA COMMUNICATIONS SYSTEMS Technical Report, Jan. 1975 - Jan. 1976
R. C. Taylor and R. J. Huff Dec. 1976 125 p refs
(Contract F30602-72-C-0162; AF Proj. 4519)
(AD-A035479; ESL-3364-5; RADC-TR-76-362) Avail: NTIS HC A06/MF A01 CSCL 17/2

This report discusses the design, operation, and capability of prototype time Division Multiple Access TDMA modems developed for RADC by the Ohio State University Electroscience Laboratory. The applicable acceptance test procedures and both bench and link test data which demonstrate that the modems operate with a high degree of effectiveness is also presented.
Author (GRA)

N77-25413# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
EVALUATION OF THE EFFECT OF TARGET MOTION ON TARGET DETECTION TIME USING A TV SENSOR
Dorwin L. Kilbourn and William R. Phillips 28 Sep. 1976 27 p refs
(AD-A035106; RG-7T-7) Avail: NTIS HC A03/MF A01 CSCL 17/8

The work discussed here was conducted in support of an internal research and development program conducted by the Missile Systems Division, Rockwell International, to determine the effect of target motion on target detection time using a TV sensor. Equally divided groups of fifty-one subjects viewed a TV displayed scenario of a stationary, a slow, or a moderately fast moving target of a tank type vehicle in a lightly cluttered rural setting. The report includes the laboratory configuration and the procedures of the experiment. Analysis of the data was the responsibility of Rockwell International and is to be reported by that organization. Author (GRA)

N77-25414# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
A COMPREHENSIVE TEST PLAN FOR THE EVALUATION OF TELEVISION CONTRAST AUTOMATIC TRACKERS
Michael C. Pitruzzello and Mark D. Dixon 20 Dec. 1976 19 p refs
(DA Proj. 1W3-62303-A-214)
(AD-A035079; RG-77-4) Avail: NTIS HC A02/MF A01 CSCL 17/7

Many types of television contrast automatic trackers are available today. However, there is no standard by which a user can compare trackers and thus choose the one best suited to

the user's needs. This standardized test plan for television contrast automatic trackers will generate data to compare the performance characteristics of various trackers. GRA

N77-25415# Duke Univ., Durham, N.C. Digital Systems Lab.
DIGITAL PULSE COMPRESSION TECHNIQUES Final Report, 1 Feb. 1974 - 1 Oct. 1976
Peter N. Marinos Jan. 1977 34 p refs
(Contract N00014-67-A-0251-0023)
(AD-A035089; TR-77-1) Avail: NTIS HC A03/MF A01 CSCL 09/4

The purpose of this work was to identify and study pulse compression techniques useful in LPI (i.e., Low Probability of Intercept) applications. More specifically, the technique proposed should be capable of compression ratios of from 128 to 1024 or higher, and integrated sidelobes of -35 to -30 db throughout the compression range; furthermore, it should be easy to mechanize, and should result in minimal S/N loss. It was concluded that nonlinear FM is the pulse-compression scheme capable of satisfying all these requirements, and existing technologies make its mechanization feasible. Author (GRA)

N77-25416# Army Electronics Command, Fort Monmouth, N. J. Product Assurance Directorate.
RELIABILITY/COST ANALYSIS OF SINCGARS-V RADIO SERIES
John P. Solomond Feb. 1976 45 p refs
(DA Proj. 1X7-63707-D-437)
(AD-A035937; ECOM-4473) Avail: NTIS HC A03/MF A01 CSCL 17/2

The SINCGARS - V radio series consists of a VHF - FM radio system, electronically tuned and controlled, which operates in the 30 to 88 MHz frequency band. Three basic subsystems are analyzed on the basis of the specified reliability 'design goal' and the cost incurred in order to obtain that reliability level. The analysis contained herein elaborates the reliability program costs, expected field support costs, and the resultant MTBF achieved in the field. Also included is an analysis of projected reliability growth efforts, including curves, during the advanced development, and engineering development phases of the requirement's life cycle. It includes a calculation of the expected reliability growth costs for each of the three subsystems, at several reliability growth rates. Author (GRA)

N77-25417# Naval Postgraduate School, Monterey, Calif.
BIT ERROR RATE MEASUREMENTS ON THE AN/WSC-3 AND AN/SSR-1 SATELLITE COMMUNICATIONS SETS
Richard F. Carlson and John E. Ohlson Oct. 1976 58 p refs
(AD-A035740; NPS-62OL76102) Avail: NTIS HC A04/MF A01 CSCL 17/2

The purpose of the investigation is to characterize the performance of the AN/WSC-3 and the AN/SSR-1 satellite communications sets. The characterization considered in the report is probability of error. The receiver's performance to random uncoded data is measured and compared to their theoretical performance. GRA)

N77-25418# Naval Postgraduate School, Monterey, Calif.
A SIMULATOR FOR SHIPBOARD RADIO FREQUENCY INTERFERENCE IN SATELLITE COMMUNICATIONS
Eduardo Brick and John E. Ohlson Oct. 1976 261 p refs
(AD-A035743; NPS-62OL76109) Avail: NTIS HC A12/MF A01 CSCL 17/2

A simulator for shipboard radio frequency interference, intended to be used in the characterization of UHF satellite communications terminals such as the AN/WSC-3 and AN/SSR-1, has been developed. A physical-statistical model for shipboard interference, based on Middleton's model for urban noise, is given. The model developed incorporates the relaevent physical aspects of the various possible interferers and postulates a statistical framework in which these signals are inserted. A simulator based on the developed model was built to serve as a tool for study of the effects of the various interferers upon shipboard satellite communications systems. The simulator is capable of generating 10 types of complex emitters and of providing linear and nonlinear processing of them. It is also capable of generating a PSK modulated test signal for performance measurements of UHF terminals. Results of performance measurements are presented. These results demonstrate the ability of the simulator to reproduce the shipboard electromagnetic environment. GRA

N77-25419# Naval Postgraduate School, Monterey, Calif.
INSTRUMENT PACKAGE FOR MEASUREMENT OF SHIPBOARD RFI
Allen Ray Shuff and John E. Ohlson Oct. 1976 77 p refs
(AD-A035812; NPS-62OL76108) Avail: NTIS HC A05/MF A01 CSCL 17/2

Shipboard RFI to UHF STACOM is a potential threat to effective naval communications. To determine the extent of this threat and to develop corrective measures, it was necessary that tests be performed to characterize the RFI in the UHF band in which the fleet satellites operate. The requirement existed for an instrumentation package having a low noise figure, a large dynamic range, and the capability of rapid field maintenance. The instrumentation package was designed and constructed at the Naval Postgraduate School, Monterey, California. The design conforms to practices which lead to good electromagnetic compatibility. The design met all design criteria and has been successfully used in collecting data to characterize shipboard RFI to UHF SATCOM. Author (GRA)

N77-25420# Naval Postgraduate School, Monterey, Calif.
CHARGE AND CURRENT DENSITY DISTRIBUTIONS ON MODERATELY THICK TRANSMITTING CROSSED-MONOPOLE ANTENNAS M.S. Thesis. Final Report, 1 Apr. - 1 Dec. 1976
William E. Beyatte and Robert W. Burton Dec. 1976 102 p refs
(AD-A035818; NPS-62Zn76121) Avail: NTIS HC A06/MF A01 CSCL 09/5

Charge and current density distributions in the vicinity of the cross junction of several configurations of electrically long, moderately thick, crossed-monopole antennas with an intersecting angle of 45 degrees were measured. The recorded data was compared with a monopole antenna with the same dimensions as the vertical segment of the crossed monopole. Junction conditions such that there would be a maximum current/minimum charge and minimum current/maximum charge on the vertical monopole were investigated. GRA

N77-25421# Naval Postgraduate School, Monterey, Calif.
DETECTION OF A LOW LEVEL SIGNAL IN NOISE BY TEGULOMETRIC METHODS M.S. Thesis
K. A. Tobin Dec. 1976 91 p refs
(AD-A035852) Avail: NTIS HC A05/MF A01 CSCL 09/4

A novel and sensitive method is described for the analysis and detection of weak signals generated by many sources and highly contaminated by noise. This process yields a spectral display whose elements are related to the probability of occurrence of a frequency rather than to the power spectral density of conventional schemes. Thus, a weak signal and stronger signals may show equally if they appear over the same percentage of the analysis period. This process, called tegulometric analysis, is tested and improved in sensitivity for detection of very weak signals hidden in Gaussian noise. The investigation shows that this method can be optimized to produce low level signal detections based upon short observational periods. The frequency resolution capability of the method is shown to be marked. Applications to acoustic signal detection are discussed. However, since electromagnetic signals suffer many of the same interference problems to which acoustic signals are subjected, it is expected that tegulometric analysis should have equal value to radar, communications, ESM, and other low signal-to-noise applications. GRA

N77-25422# TRW Defense and Space Systems Group, Redondo Beach, Calif.
CURRENT COMPUTATION BY THE FINITE ELEMENT METHOD Final Report
A. Sankar and T. C. Tong Nov. 1976 97 p refs
(Contract N00123-76-C-0729)
(AD-A035223) Avail: NTIS HC A05/MF A01 CSCL 20/3

The problem concerning scattering of a plane electromagnetic wave from a thin conducting square plate is easy to formulate but very difficult to solve. The major difficulties are due to (1)

the edge condition, (2) the highly if not nonintegrable singularity of the dyadic Green's function associated with a two-dimensional surface, and (3) the stability problem caused by its thinness. Obviously, attempts to seek a closed form solution are bound to fail, and the only promising approach is to use numerical methods. Although the moment method has been demonstrated in many cases to be a very successful numerical method for electromagnetic problems, its application to a two-dimensional problem has not been good. The MOM offers two approaches to solve the surface current problems. One is the wire grid modeling which suffers from many numerical and physical difficulties. The geometrical structure is modeled into a wire grid representation and the results are sensitive to selected wire radius. Grid representation of the structure has loops and thus loop currents can be excited which are manifestly unphysical. Again, depending on the grid structure, internal resonance may occur and thus, alter the external resonances. The other approach is the surface patch modeling. Here the results seem to vary drastically with slight changes in patch size. GRA

N77-25423# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF ATMOSPHERIC NOISE STATISTICS RECORDED AT VIENNA, NEW YORK
Wayne Bonser, Anthony J. Mlinar, and George A. Pfeiffer Feb. 1977 166 p
(AD-A038017) Avail: NTIS HC A08/MF A01 CSCL 04/1

This report documents the preliminary work performed in the field of Atmospheric Noise Analysis. The data presented in this report characterizes the 'real-world'; atmospheric noise conditions as were observed during the first half of 1975 at Vienna, New York, and gives the VLF communication community an opportunity to become familiar with the equipment, the methods, and the statistics collected. Author (GRA)

N77-25424# Rice Univ., Houston, Tex. Dept. of Chemistry.
ELECTRON SCAVENGING RESEARCH Final Report, 1 Jan. 1975 - 30 Jun. 1976
1 Feb. 1977 6 p
(Contract N00014-75-C-0415; AF Proj. 1224)
(AD-A036012) Avail: NTIS HC A02/MF A01 CSCL 09/3

In 1970 we proposed a research project directed towards development of information that might lead to a method of scavenging electrons from hot gases such as jet and rocket engine exhausts. The presence of electrons in such hot gases interferes with communication to the vehicle and it would be desirable to remove them. Such removal would almost certainly have to be accomplished by attachment to molecules or free radicals normally present or introduced into the hot gases. Unfortunately, at the time there was relatively little information concerning electron affinities of molecules and radicals or of the processes leading to the formation of such negative ions. Our project, then, was directed towards the study of such processes with a view to identifying those that would lead to the formation of negative ions in the appropriate energy range and of measuring the electron affinities of various important species. GRA

N77-25425# Ohio State Univ., Columbus. ElectroScience Lab.
THE TRANSIENT RESPONSE OF ADAPTIVE ARRAYS IN TDMA SYSTEMS Interim Report
T. W. Miller Griffiss AFB, N. Y. RADC Dec. 1976 326 p refs
(Contract F30602-75-C-0061)
(AD-A036068; ESL-4116-1; RADC-TR-76-390) Avail: NTIS HC A15/MF A01 CSCL 17/2

This report investigates the performance which can be obtained by utilizing adaptive arrays to suppress undesired signals in coded communications systems. Emphasis is placed on determining the factors which limit the rate at which the array can respond to a time-varying signal environment, e.g., the environment which exists in a time-division multiple access (TDMA) communication system. The performance of adaptive arrays implemented with the LMS algorithm is evaluated analytically and experimentally. The direct matrix inversion algorithm is also investigated analytically to compare LMS algorithm response with the response obtained when estimates of the input signal parameters required to implement an optimal array processor are used in a direct manner to calculate the adaptive array weights. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N77-25426* Bendix Corp., Davenport, Iowa. Instruments and Life Support Div.
DESIGN, DEVELOPMENT AND MANUFACTURE OF A BREADBOARD RADIO FREQUENCY MASS GAUGING SYSTEM (PHASE D) Final Report
7 Jan. 1977 265 p refs
(Contract NAS8-30160)
(NASA-CR-150282; Publ-7506) Avail: Issuing Activity CSCL 14B

The design and fabrication of improved RF gauging test hardware was reviewed. The test hardware contains a microprocessor to provide data processing functions, and is designed to permit adaptability and flexibility for future test configurations. Using an improved data acquisition system, the RF gauging test hardware was tested using liquid oxygen contained in the vacuum-insulated cryogenic test tank. Author

N77-25427 British Library Lending Div., Boston Spa (England).
ANALYSIS OF THE PROPERTIES OF MAGNETIC CIRCUIT LOUDSPEAKER WITH CONSIDERATION OF VIBRATING COIL DIMENSIONS
Inz Zuchowski and Inz. J. Gasiorowska Nov. 1976 17 p refs Transl. into ENGLISH from Prace Inst. Tele i Radiotechnicznego (Poland), v. 17, no. 3 (64), 1973 p 17-32
(BLL-RTS-9781) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The distribution of the magnetic field along the circuit gap was determined on the basis of the method of conformal representation of the regions. Formulas were derived for the optimum dimensions of the vibrating coil under the conditions of maximum efficiency and maximum effectiveness of the loudspeaker. A numerical example is presented and the results of calculations were compared with the results of experimental determinations. Author

N77-25428*# Ball Bros. Research Corp., Boulder, Colo.
DEVELOPMENT OF A MICROSTRIP UHF CONFORMAL ANTENNA Final Report
Michael W. Shields and R. B. Cassell 18 Apr. 1977 30 p ref
(Contract NAS9-14947)
(NASA-CR-151416; F77-09) Avail: NTIS HC A03/MF A01 CSCL 09C

Low profile, engineering model EMU antennas were constructed. Final data for these antennas meet most of the electrical requirements in a 6 in. x 18 in. x 1.4 in. package which weighs under 2.0 lbs. Coverage data calculated at the design frequencies very nearly meets the design goal of providing a gain greater than or equal to -10 dBi over 80% of a sphere. Recommendations are made for future work directed toward producing an efficient quality design capable of operating in a space environment. Author

N77-25429*# Fairchild Imaging Systems, Syosset, N. Y.
SOLID STATE TELEVISION CAMERA (CCD-BURIED CHANNEL), REVISION 1 Final Report
Apr. 1977 79 p Revised
(Contract NAS9-14844)
(NASA-CR-151418; ED-AX-76-Rev-1) Avail: NTIS HC A05/MF A01 CSCL 09A

An all solid state television camera was designed which uses a buried channel charge coupled device (CCD) as the image

sensor. A 380 x 488 element CCD array is utilized to ensure compatibility with 525-line transmission and display monitor equipment. Specific camera design approaches selected for study and analysis included (1) optional clocking modes for either fast (1/60 second) or normal (1/30 second) frame readout, (2) techniques for the elimination or suppression of CCD blemish effects, and (3) automatic light control and video gain control techniques to eliminate or minimize sensor overload due to bright objects in the scene. Preferred approaches were determined and integrated into a deliverable solid state TV camera which addressed the program requirements for a prototype qualifiable to space environment conditions. Author

N77-25430# Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.

PLANNING CRITERIA OF THE REPEATER STATION FOR CIRCULAR WAVEGUIDE SYSTEMS [CRITERI DI PROGETTO DELLA STAZIONE REPETITRICE DI SISTEMI IN GUIDA D'ONDA CIRCOLARE]

E. Carli (Trieste Univ., Italy), T. Corzani (Trieste Univ., Italy), and G. B. Stracca (Politec. di Milano) 23 Apr. 1976 121 p refs In ITALIAN

Avail: NTIS HC A06/MF A01

The various aspects to be taken into account in planning the equipment of repeater stations for telecommunication systems with circular waveguides, and the ways in which the system itself can be realized, are dealt with. The aspects considered are: costs of the equipment, number of channels, branching filters, and type of modulation and demodulation. The reasons for distortion in group delay and amplitude occurring in circular waveguides are examined. ESA

N77-25431# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.

CALCULATION OF THE SCATTERING MATRIX OF A MULTIPORT FROM ITS CURRENT-VOLTAGE CHARACTERISTICS [DIE BERECHNUNG DER STREUMATRIX EINES MEHRTORS AUS SEINEN STROM-SPANNUNGSBEZIEHUNGEN]

Guenter Morgenstern Jan. 1976 10 p refs In GERMAN

(IND-FB-80) Avail: NTIS HC A02/MF A01

Formulas are presented for the calculation of the scattering matrix of a multiport, for which neither a resistance matrix nor an admittance matrix exist. Examples are given of application to an ideal transformer with three coils and a hybrid coil. ESA

N77-25432# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

MODELIZATION OF QUARTZ OSCILLATORS Ph.D. Thesis - Paris 6 Univ.

Patrick Bressy Feb. 1977 97 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-384)

(ONERA-NT-1976-13) Avail: NTIS HC A05/MF A01

Any improvement of the quality of quartz frequency standards requires a thorough study of all oscillator parameters, the fluctuations of which, whether random or not, may cause a degradation of frequency stability due to either the resonator or the oscillator electronics. Only the latter is developed. An attempt was made to establish as complete a modelization as possible of the oscillator active circuits and to demonstrate its validity by comparing the theoretical results issued from this modelization to experimental results. It is the oscillator starting period that permits an efficient verification of the model validity. The direct treatment of the oscillator differential equations does not yield in practice the solution describing the whole transient regime; this is due in particular to the very high value of the resonator quality factor. A mathematical model making use of the theories of the first harmonic and of perturbations makes it possible to emphasize the frequency and amplitude variations of the signal during the whole transient regime. The oscillator under study is of Pierce type. Two kinds of modelization have been considered. The first reduces the oscillator electronics to a single voltage amplifier with a nonlinear characteristic of quadratic type. The second makes use of the Ebers and Moll transistor model. The excitation level of the quartz being particularly high in this type of oscillator, it is necessary to introduce in the resonator equivalent scheme nonlinear parameters whose effect is to provoke a frequency shift in the sense opposite to that resulting from the amplifying unit. This way, through an appropriate choice of the shape of the nonlinear characteristic of the active circuit, it is possible to attenuate the frequency variations caused by the fluctuations of the oscillation amplitude. Author (ESA)

N77-25433# Hughes Research Labs., Malibu, Calif.

CROSSED-FIELD CLOSING SWITCH DEVELOPMENT Final Report, 8 Jan. - 31 Dec. 1976

Robin J. Harvey Jan. 1977 33 p refs

(Contract DAAB07-76-C-1313)

(AD-A035609; ECOM-76-1313-F) Avail: NTIS HC A03/MF A01 CSCL 09/5

A triode version of the crossed-field closing switch (CFSC) has been successfully tested at average powers of up to 800 KW -40 KA, 40 kV, 12 microsec pulse width at 80 Hz for burst durations of 30 sec. Unlike most cconventional spark gaps, the arc is initiated from a crossed-field glow discharge and occurs at random locations on a shot-to-shot basis. This uniformly disperses the heat loading and erosion over a relatively large electrode surface area which may then be cooled. Author (GRA)

N77-25434# Stanford Univ., Calif. Solid-State Electronics Lab.

TIN OXIDE AND RELATED OXIDES WITH REGARD TO COLD CATHODES Final Report, 1 Apr. 1974 - 15 Sep. 1976

R. A. Powell and W. E. Spicer 15 Sep. 1976 41 p refs

(Contract DAAG29-74-C-0022)

(AD-A035630; ARO-12514.3-P) Avail: NTIS HC A03/MF A01 CSCL 09/1

The results of a study which was originated in order to provide fundamental knowledge of the emission mechanism for SnO2 cold electron emitters are reported. Instead of satisfactorily completing that objective, this work has brought into focus the fact that reports of practically important cold emission from such devices is based on a limited number of cathodes and that it has been impossible to reproduce these cathodes. As a result, no such cathodes were made available for study under this program. Thus, the major finding of this work is that SnO2, or closely related, In-Sn-Oxide, cold cathodes with large emission currents are anomalies which cannot be reproduced at will. Further, it is apparent that only if a major and extremely well through out and expensive program is undertaken can substantial hope be given to producing such practical cathodes. It is not apparent to the present workers that such a program would be a good investment. Before that decision can be made, some essential groundwork should be done to determine if these cathodes can be economically incorporated into existing devices. Measurements of the spatial and energy spread of emitted electrons should have a high priority. GRA

N77-25435# RCA Labs., Princeton, N. J.

SEMICONDUCTOR MEASUREMENT TECHNOLOGY: SAFE OPERATION OF CAPACITANCE METERS USING HIGH APPLIED-BIAS VOLTAGE Interim Report

Alvin M. Goodman Dec. 1976 61 p refs

(ARPA Order 2397)

(PB-262580/4; PRRL-76-CR-27; NBS-SP-400-34; LC-76-60338) Avail: NTIS HC A04/MF A01 CSCL 14B

A technique was developed for using a commercial C-meter with a bias isolation unit (BIU) for capacitance measurements at bias-voltage magnitudes up to 10 kV without damage to the measurement equipment. The basic principles of operation and the details of the electrical design of a BIU are discussed. GRA

N77-25436# Harry Diamond Labs., Adelphi, Md.

AUTOMATIC ASSEMBLY OF HYBRID CIRCUITS ON A CERAMIC SUBSTRATE

Aaron A. Miller and J. G. F. Bouchard Dec. 1976 21 p

(AD-A035276; HDL-TM-76-27) Avail: NTIS HC A02/MF A01 CSCL 09/5

A system was developed to mass produce thick-film hybrid integrated circuits on ceramic substrate. This technology was tested successfully with the production of 3000 XM734 multioption fuze amplifier assemblies. The high-volume, continuous production applies to military environments and incorporates high component density. Nonrecurring costs in capital equipment and

minimal labor are among the major economic advantages.
Author (GRA)

N77-25437# Army Electronics Command, Fort Monmouth, N. J. Communications and ADP Lab.
EVALUATION OF THE TUNABLE SOLID STATE POWER AMPLIFIER FOR RECEIVER-TRANSMITTERS RT-246/VRC AND RT-524/VRC Final Report, Jun. - Aug. 1976
Walter D. Patterson Jan. 1977 46 p refs
(AD-A035469; ECOM-4460) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report presents results of electrical tests on the solid state power amplifier for Receiver- Transmitters RT-246/VRC and RT-524/VRC developed by the RF Communications Division of the Harris Corporation, Rochester, N.Y., under contract number DAAB07-75-C-0146. The equipment was tested with regard to power output at room temperature, temperature extremes, and at input voltages of 22 to 30 Vdc spurious emissions and intermodulation dc input requirements amplifier protection and duty cycle capability. All test results show satisfactory performance of the test items. However, power output at T150 F ambient temperature and harmonic attenuation in the high band are marginal. Author (GRA)

N77-25438# Stanford Univ., Calif. Center for Materials Research.
GENERATION OF COHERENT VUV AND SOFT X-RAYS Semiannual Report, 1 Jul. - 31 Dec. 1976
S. E. Harris and J. F. Young Jan. 1977 9 p refs
(Contract N00014-75-C-1175; ARPA Order 2782)
(AD-A035442; CMR-76-17; GL-2655; SAR-3) Avail: NTIS HC A02/MF A01 CSCL 20/6

The goal of this program is the generation of coherent extreme ultra-violet and soft X-ray coherent sources. The general method employed is optical nonlinear harmonic generation in gaseous media. There are basically two complementary approaches which can be used. The first is to utilize successive low-order processes, taking advantage of resonance enhancements to create large nonlinear coefficients. The second approach is to generate short wavelength radiation in a single high-order nonlinear stage, utilizing extremely high power densities to achieve observable signal levels. During the past period both of these approaches have been investigated, and our results are described in the following sections. Author (GRA)

N77-25439# RAND Corp., Santa Monica, Calif.
BASIC LIMITATIONS IN MICROCIRCUIT FABRICATION TECHNOLOGY
Ivan E. Sutherland, Carver A. Mead, and Thomas E. Everhart Nov. 1976 58 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-A035149; R-1956-ARPA) Avail: NTIS HC A04/MF A01 CSCL 09/5

The report discusses some high-leverage research areas in microcircuit fabrication, not now receiving government or private support, where relatively small, advanced research efforts may have substantial payoff. Based on the fact that microcircuit fabrication has reached or almost reached limitations in both size and precision, the study focuses on a number of areas where progress can be made, identifying those adequately covered by existing programs and highlighting those where relatively little work is being done. The authors recommend four important research efforts aimed at: (1) making small devices; (2) measuring the limits of dimensional stability of silicon substrates and mask materials; (3) predicting the optimum feature size, die size, and wafer size, given the constraints of the newly evolving technology; (4) understanding the system design implications of very-large-scale integrated circuits. 'The potential for future capability is truly impressive' say the authors, who believe that the integrated circuit revolution has run only half its course and that a change in microcircuit complexity of four more orders of magnitude is highly probable. GRA

N77-25440# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A USER-ORIENTED POWER DISTRIBUTION SYSTEM ANALYSIS PROGRAM M.S. Thesis
Jesse Allen Underwood, Jr. Dec. 1976 258 p refs
(AD-A035292; GE/EE/76-43) Avail: NTIS HC A12/MF A01 CSCL 10/2

The program capacity is 250 buses and 500 line elements, with 250 of the line elements being transformers. Input routines accept data as impedances, or as descriptive information such as wire size, length, or transformer ratings. For descriptive data, the program uses pre-calculated approximations to derive the impedance values for the various line elements and the program will adjust impedance values due to neutral conductors in the system. The load flow routine uses the fast-decoupled Newton-Raphson technique and has the capability of changing loads to represent load growth within the system. The short circuit routine analyzes systems in 50 bus groups, simulating various types of faults for each bus. Bus voltages and line currents in the system are calculated for each simulated fault. A comprehensive User's guide is written which provides clear and concise instructions for operating the program. GRA

N77-25441# Naval Surface Weapons Center, White Oak, Md.
THE 1/F NOISE IN AMORPHOUS GeTe
K. Peter Scharnhorst 18 Jun. 1976 36 p refs
(ZR00001010; ZF6111200123)
(AD-A035105; NSWC/WOL/TR-76-97) Avail: NTIS HC A03/MF A01 CSCL 20/12

An experiment designed to determine the 1/f noise power of amorphous semiconductors in the presence of electrode noise is described. Results of measurements of the room temperature current noise power spectral density of amorphous GeTe are presented. GRA

N77-25442# Naval Civil Engineering Lab., Port Hueneme, Calif.
ALUMINUM FRAME MOTORS: ENVIRONMENTAL TESTING Final Report, Jul. 1975 - Jun. 1976
David E. Weems Dec. 1976 13 p
(YF53534006)
(AD-A035802; CEL-TN-1464) Avail: NTIS HC A02/MF A01 CSCL 09/3

The Civil Engineering Laboratory has conducted environmental tests to determine if aluminum frame motors instead of cast iron frame motors would be suitable for use in salt fog environments similar to those experienced at Naval Shore Facilities. The aluminum frame in the salt fog environment had minimal corrosion, indicating it is superior to cast iron for these applications. During the laboratory testing the steel shaft corroded sufficiently to inhibit rotation after prolonged exposure. This was due to the shaft being stationary during testing. This suggests that the shaft of this motor should be rotated periodically in corrosive environments to eliminate seizure. Author (GRA)

N77-25443# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
ROLE OF MOBILE IONIC SPECIES IN POLYMER ELECTRETS Interim Report
S. H. Carr 20 Jan. 1977 15 p refs
(Contract N00014-75-C-0963)
(AD-A035789; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/3

This paper is a preliminary, abridged review of current ideas regarding mobile ionic species in polymer electrets. The chief concept is that much of the persistent electrical polarization, developed in polymers prepared for piezo- or pyroelectric applications, is due to displaced ions. It is recognized that (1) preferential orientation of dipolar parts of the macromolecules (e.g., side groups), and (2) fluctuations in supermolecular order including crystalline regions lead to inhomogenieties in internal electrical fields which affect where such mobile ions become stabilized (trapped). Emphasis is placed on results obtained recently from research on polyacrylonitrile electrets. Author (GRA)

N77-25444# California Univ., Los Angeles. School of Engineering and Applied Science.
LITHIUM-GRAPHITE SECONDARY BATTERY
Douglas N. Bennion and Sanjay L. Deshpande Dec. 1976 94 p refs
(Contract N00014-75-C-0794)
(AD-A035409; UCLA-ENG-76127) Avail: NTIS HC A05/MF A01 CSCL 10/3

Reactions occurring at the positive and negative electrodes

and in the solution phase of cells of the type Li/LiClO4, DMSU/Graphite have been studied. Experiments were performed in an H-cell wherein the two electrodes of the cell were isolated in compartments separated by a porous glass frit. Discharge capability of 36 hours at a current density of 2 mA/cm square have been demonstrated. Discharge potential was about 3.00 V measured versus a lithium wire reference electrode. The effect of operating current on cell performance has been studied. The role of each component of the battery in the charging and discharging reactions has been investigated. Author (GRA)

N77-25445# Air Force Weapons Lab., Kirtland AFB, N.Mex.
PLATE: A 2-D TRANSMISSION LINE CURRENT SYMMETRY CODE Final Report
John A. Justice Jan. 1977 106 p refs
(AF Proj. 8809)
(AD-A036161; AFWL-TR-76-205) Avail: NTIS HC A06/MF A01 CSCL 09/1

This report is primarily intended as a users manual for the two-dimensional current flow code PLATE. The current symmetry to a thin cylindrical foil that is being imploded by the j bar x B bar force in a short z-pinch device is considered. The code PLATE calculated azimuthal current asymmetries to the experimental load for various capacitor bank and parallel plate transmission line configurations. A discussion of numerical techniques is included. Two sample problems are discussed. A complete listing and sample output are included. Author (GRA)

N77-25446# Army Electronics Command, Fort Monmouth, N. J.
A BLUMLEIN MODULATOR FOR A TIME-VARYING LOAD
Sol Schneider, William H. Wright, Jr., and Anthony J. Buffa Oct. 1976 25 p
(DA Proj. 1S7-62705-AH-94)
(AD-A035102; ECOM-4447) Avail: NTIS HC A02/MF A01 CSCL 09/8

A modulator has been built to drive a time-varying-impedance load. A Blumlein circuit, with two identical pulse forming networks, was used to produce an effective voltage of twice the charging voltage. A dissipative clamper circuit was included to simulate a well-behaved load. The switch is a 10 section iterative cavity-grid thyratron designed for 250 kilovolts (kV) and 20 kiloamperes (kA) peak current. The modulator has been operated at 210 kV at a repetition rate of a few hertz (Hz). Author (GRA)

N77-25447# Edgerton, Germeshausen and Grier, Inc., Salem, Mass. Electronic Components Div.
REPETITIVE SERIES INTERRUPTER II Triannual Report, 26 Jan. - 23 May 1976
David V. Turnquist Dec. 1976 16 p refs
(Contract DAAB07-76-C-1301)
(AD-A035267; ECOM-76-1301-1; Rept-1) Avail: NTIS HC A02/MF A01 CSCL 09/1

The objective of the effort is to obtain an improved exploratory development model of the 15 kilovolts series interrupter. Designs of experimental devices, based on hydrogen thyratron techniques, are described. A test circuit has been constructed, and the test results obtained to date are discussed. GRA

N77-25448# Harry Diamond Labs., Adelphi, Md.
DEVELOPMENT OF APPARATUS FOR PERFORMING RAPID CAPACITANCE-VOLTAGE MEASUREMENTS ON MIS STRUCTURES
H. Edwin Boesch, Jr. Dec. 1976 31 p refs
(DA Proj. 1T1-61102-AH-44)
(AD-A035249; HDL-TM-76-33) Avail: NTIS HC A03/MF A01 CSCL 20/3

This report discusses the design of a complete experimental system for the observation of radiation effects in metal-insulator-semiconductor (MIS) capacitors by use of a rapid, repetitive capacitance-voltage (C-V) measurement technique. The apparatus includes trigger and control-signal generators, bias voltage sources, a sample holder with temperature control and radiation dosimetry, and a high-speed sample capacitance monitor. In typical operation, this apparatus repetitively measures the C-V characteristics of an MIS capacitor at intervals spaced logarithically in time from 0.1 ms to 800 s, after a radiation pulse. Characteristics and operating principles of the major system components are discussed and sample test results are presented. Author (GRA)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N77-25449 British Library Lending Div., Boston Spa (England).
COMBINED COOLING OF PERFORATED PLATES IN CONTACT WITH A TURBULENT STREAM OF GAS
V. V. Glazkov, M. D. Guseva, and B. A. Zhestkov Dec. 1976 6 p refs Transl. into ENGLISH of paper from Russian conf. Presented at 5th All-Union Conf. on Heat and Mass Transfer, Minsk, 1976, v. 1 p 97-101
(BLL-RTS-10443) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The heat transfer coefficient is expressed as a sum of two components characterizing, respectively, the external heat loss and the heat loss within the internal channels of the wall. To determine the coefficient a special experiment was set up with electrically heated perforated plates. One side of these plates was carefully thermally insulated. Cooling air flowed over the uninsulated side of the plate, part of it flowing through the perforations into a channel maintained at a constant pressure. The heat transfer coefficient for a perforated wall with (pv) sub w = 0 is somewhat higher than that for a smooth wall, because of the additional heat transfer within the perforations. Author

N77-25450 British Library Lending Div., Boston Spa (England).
MODERN METHODS FOR CALCULATION OF PRESSURE DROPS IN TWO-PHASE FLOW OF COOLING AGENTS
P. Toma Mar. 1977 30 p refs Transl. into ENGLISH from Ind. Aliment. (Bucharest), v. 24, no. 2, 1973 p 65-71
(BLL-RTS-9963) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

The pressure drop in a system of large number of pipe sections - in which the physical parameters of the vapors and liquid are considered constant - is the sum of the effective pressure drop in the individual pipe sections. On this premise a computer subroutine was developed to express the two phase flow of cooling agents in a system. I.M.

N77-25451 British Library Lending Div., Boston Spa (England).
FUNDAMENTALS OF HEAT TRANSFER IN VAPOUR GENERATION
K. Stephen and G. Hesse Mar. 1977 16 p refs Transl. into ENGLISH from CZ Chem. Tech. (West Ger.), v. 1, no. 9, 1972 p 421-425
(BLL-RTS-9962) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

A review of mechanisms of evaporation by ebullition is followed by a discussion of models and equations for calculation of the heat transfer. Each known model is seen to describe individual partial processes in heat transfer, but there is still no completely satisfactory theory. Hence calculation of the heat transfer coefficient by the tabulated equations is to some extent uncertain. Author

N77-25452 British Library Lending Div., Boston Spa (England).
BASIC CALCULATION FOR FLOW MEASUREMENTS WITH NOZZLES, ORIFICE PLATES, AND VENTURI TUBES: UNCERTAINTIES OF MEASUREMENT
20 Dec. 1976 23 p refs Transl. into ENGLISH of West German report In GERMAN and ENGLISH
(BLL-NEL-TT-2682-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

The calculation of the overall measurement uncertainty for various flow conditions is considered. Equations are given for

the overall uncertainty for individual measurements with and without automatic evaluation, and with and without consideration of the changes in state. Equations are also given for series and/or parallel circuits and multiple measurements. D.M.L.

N77-25453*# Kanner (Leo) Associates, Redwood City, Calif.
CALCULATION OF VISCOELASTIC FLOW IN A SQUARE CAVITY
F. Baudier and P. Avenas Washington NASA May 1977 15 p refs Transl. into ENGLISH from Proc. of the Third Intern. Conf. on Numerical Methods in Fluid Mech., Vol. 2: Probl. of Fluid Mech. (France), 1973 p 10-18 Presented at 3d Intern. Conf. on Numerical Methods in Fluid Mech., Paris, 3-7 Jul. 1972
(Contract NASw-2790)
(NASA-TT-F-17425) Avail: NTIS HC A02/MF A01 CSCL 20D

A method is discussed for numerically calculating viscoelastic flow in a square cavity and attempt to evaluate the difference in viscous flow characteristics and newtonian flow characteristics as a function of the elasticity of the fluid. The results obtained seem to show that the flow of the vortex decreases when the elasticity of the fluid increases, and this decrease shows up all the more as the Reynolds number is increased. Author

N77-25454*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLOW AND HEAT TRANSFER IN A CURVED CHANNEL
Paul F. Brinich and Robert W. Graham Washington May 1977 40 p refs
(NASA-TN-D-8464; E-9027) Avail: NTIS HC A03/MF A01 CSCL 20D

Flow and heat transfer in a curved channel of aspect ratio 6 and inner- to outer-wall radius ratio 0.96 were studied. Secondary currents and large longitudinal vortices were found. The heat-transfer rates of the outer and inner walls were independently controlled to maintain a constant wall temperature. Heating the inner wall increased the pressure drop along the channel length, whereas heating the outer wall had little effect. Outer-wall heat transfer was as much as 40 percent greater than the straight-channel correlation, and inner-wall heat transfer was 22 percent greater than the straight-channel correlation.
Author

N77-25455*# Bell Aerospace Co., Buffalo, N. Y.
DEVELOPMENT AND VALIDATION OF PURGED THERMAL PROTECTION SYSTEMS FOR LIQUID HYDROGEN FUEL TANKS OF HYPERSONIC VEHICLES
R. D. Helenbrook and J. Z. Colt Washington NASA Jun. 1977 124 p refs Prepared in cooperation with Arthur D. Little, Cambridge, Mass.
(Contract NAS1-10969)
(NASA-CR-2829; Rept-8653-950001) Avail: NTIS HC A06/MF A01 CSCL 11D

An economical, lightweight, safe, efficient, reliable, and reusable insulation system was developed for hypersonic cruise vehicle hydrogen fuel tanks. Results indicate that, a nitrogen purged, layered insulation system with nonpermeable closed-cell insulation next to the cryogenic tank and a high service temperature fibrous insulation surrounding it, is potentially an attractive solution to the insulation problem. For the postulated hypersonic flight the average unit weight of the purged insulation system (including insulation, condensate and fuel boil off) is 6.31 kg/sq m (1.29 psf). Limited cyclic tests of large specimens of closed cell polymethacrylimide foam indicate it will withstand the expected thermal cycle. Author

N77-25456*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ROCKET EXHAUST EFFLUENT MODELING FOR TROPOSPHERIC AIR QUALITY AND ENVIRONMENTAL ASSESSMENTS
J. Briscoe Stephens and Roger B. Stewart Jun. 1977 84 p refs
(NASA-TR-R-473; M-222) Avail: NTIS HC A05/MF A01 CSCL 20D

The various techniques for diffusion predictions to support air quality predictions and environmental assessments for aerospace applications are discussed in terms of limitations imposed by atmospheric data. This affords an introduction to the rationale behind the selection of the National Aeronautics and Space Administration (NASA)/Marshall Space Flight Center (MSFC) Rocket Exhaust Effluent Diffusion (REED) program. The models utilized in the NASA/MSFC REED program are explained. This program is then evaluated in terms of some results from a joint MSFC/Langley Research Center/Kennedy Space Center Titan Exhaust Effluent Prediction and Monitoring Program. Author

N77-25457# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF ONE-DIMENSIONAL NONSTATIONARY VISCOUS GAS FLOWS BY USING AN IMPLICIT DIVERGENT DIFFERENCE SCHEME
Iu. M. Lipnitskii and A. V. Panasenko 1977 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 1, 1977 p 97-104
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Use of an implicit divergent difference scheme is proposed for a computation of one-dimensional nonstationary viscous gas flows. The method is demonstrated in examples: (1) computation of the formation of a shock profile; (2) computation of the flow in front of a heat conducting piston propelled in a gas; and (4) computation of viscous shock reflection from a heat conducting and heat insulated walled. Author

N77-25458# California Univ., Livermore. Lawrence Livermore Lab.
REYNOLDS NUMBER DEPENDENT SCHEME FOR THE SOLUTION OF DIABOLIC EQUATIONS
Barry R. Bowman and L. A. Truong 1976 21 p refs Presented at 9th AIAA Fluid and Dynamics Conf., San Diego, Calif., 14 Jul. 1976
(Contract W-7405-eng-48)
(UCRL-77631; Conf-760739-1) Avail: NTIS HC A01/MF A01

A numerical procedure for solving diabolic equations (conservative equations containing positive source terms) is presented. The solution scheme is forward differenced in time and centrally differenced in space. Every term except the time derivative is expressed as a convex combination of the present and the advanced time step. The selection of the convex combination is determined by analyzing the magnitude of the coefficients of a linear one-dimensional model equation together with the spatial and temporal step sizes. Typical examples of numerical solutions to the equation are compared for different convex combinations. These results indicate that the judicious choice of the combination may avoid some of the difficulties encountered when using purely implicit or purely explicit schemes. A computer automated method analysis is developed with particular application to reacting flows, mixed phase flows, and some aspects of turbulence modeling.
ERA

N77-25459# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
CALCULATION OF A BOUNDARY LAYER INTERACTING WITH A NORMAL SHOCK BY A DISCONTINUITY ANALYSIS
A. G. Panaras Oct. 1976 58 p refs
(VKI-TN-121) Avail: NTIS HC A04/MF A01

A discontinuity analysis for the estimation of the characteristics of a nonseparating turbulent boundary layer downstream of its interaction with a normal shock was developed in order to provide the pressure distribution and the extent of the interaction so that a prediction scheme will emerge, capable of providing the means for the evaluation of the major features of the interaction flow field. The independence of the basic equations from a length scale makes possible the derivation of a criterion for the normal shock induced incipient separation as well as the physical explanation to the observed behavior of the separation pressure for increasing upstream Mach number. Author (ESA)

N77-25460# National Aerospace Lab., Amsterdam (Netherlands). Space Flight Div.
A THEORETICAL INVESTIGATION OF GAS CONDUCTION EFFECTS ON MULTILAYER INSULATION PERFORMANCE
A. A. M. Delil and J. F. Heemskerk 9 Nov. 1976 71 p refs

(Contract NIVR-1766)
(NLR-TR-76018-U) Avail: NTIS HC A04/MF A01

The thermal performance of multilayer insulation blankets depends on three (interacting) modes of energy transfer: radiation between the radiation shields, gas conduction in the residual interstitial gas, and solid conduction via the contacting interfaces. The contribution of the gas conduction depends on the interstitial gas and its pressure, which are determined mainly by the temperature dependent outgassing of the shield and spacer materials. Special attention was given to the actual problems of the insulation of the storage of cryogenic liquids in vessels, the insulation of black boxes from space environment, and the effect of gas sources surrounded by multilayer insulation. The results indicate that perforation of the shields reduces the insulation properties of a blanket considerably. Hence for cryogenic storage, non-perforated shields are to be preferred. In space, cutted shields are to be preferred because they allow fast depressurization without impairing the radiation properties. Author (ESA)

N77-25461# European Space Agency, Paris (France).
MULTIPLE AND UPSTREAM TRAVELLING WAVES IN FREE JETS
Dietrich Bechert Mar. 1977 56 p refs Transl. into ENGLISH of 'Ueber mehrfache u. stromauf laufende Wellen in Freistrahlen', DFVLR, Berlin Report DLR-FB-72-06, 22 Feb. 1972 Original report in GERMAN previously announced as N72-28284 Original German report available from DFVLR, Porz, West Ger. DM 26,10; original contains color plates
(ESA-TT-370; DLR-FB-72-06) Avail: NTIS HC A04/MF A01

The stability of plane and circular free jets was investigated. The investigations were limited to the frictionless incompressible stability problem with spatially growing waves. In order to treat the problem analytically, simple models for the boundary layer were used. The evaluation of the calculations showed the existence of a variety of additional modes besides those which are already known. These additional modes have strong phase shifts of the alternating pressure and velocity in a cross section perpendicular to the flow direction; therefore it is argued that the existence of these - not yet measured - additional modes depends sensitively on the boundary layer profile and on additional boundary conditions, i. e., the boundary of the nozzle. The influence of the boundary layer profile was investigated using simplified calculations, which show that the number of additional modes becomes smaller with increasing boundary layer thickness.
Author (ESA)

N77-25462# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROGRESS IN THE CALCULATION OF TWO AND THREE DIMENSIONAL TURBULENT BOUNDARY LAYERS
Jean Cousteix Dec. 1976 29 p refs In FRENCH; ENGLISH summary Presented at the 13th AAAF Colloq. d'Aerodynamique Appl., Lyon, 8-10 Nov. 1976 Report will also be announced as translation (ESA-TT-385)
(ONERA-NT-1976-15) Avail: NTIS HC A03/MF A01

The main types of methods for calculating turbulent flows are reviewed in the frame of their application to boundary layer prediction. Their performances are evaluated by means of comparisons with various experiments in two dimensional flow. The use of these methods is also discussed in the case of three dimensional boundary layers. Author (ESA)

N77-25463# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
SPECIFICATION FOR THE MEASUREMENT OF THE THERMO-OPTICAL PROPERTIES OF THERMAL-CONTROL MATERIALS AT ESTEC
Paris ESA Feb. 1977 23 p refs
(ESA-PSS-16/QRM-09T-Issue-1) Avail: NTIS HC A02/MF A01

A specification is presented of instruments and equipment, their settings, and the methods of calculation used to determine the two thermo-optical properties of thermal-control materials: solar absorptance and total hemispherical emittance. The sizes of test pieces submitted for measurements at ESTEC are also stated and the precautions that have to be taken are indicated.
Author (ESA)

N77-25464# Iowa Inst. of Hydraulic Research, Iowa City.
HEAT TRANSFER ANALYSIS FOR UNSTEADY HIGH VELOCITY PIPE FLOW. PART 1: ON MINIMIZATION OF TEMPERATURE DISTORTION IN THE THERMOCOUPLE CAVITY. PART 2: IMPROVED ACCURACY IN THE PREDICTION OF SURFACE HEAT FLUX AND TEMPERATURE BY INTRINSIC THERMOCOUPLE. PART 3: PREDICTION OF TRANSIENT SURFACE HEAT FLUX AND TEMPERATURE ON A HOLLOW CYLINDER
Ching Jen Chen, Jenq Shing Chiou, Peter Li, and Hsai Yin Lee Oct. 1976 79 p refs
(Grant DAAG29-76-G-0123)
(AD-A035613; IIHR-195-Pt-1/2/3) Avail: NTIS HC A05/MF A01 CSCL 20/4

The work done for the project is reported here in three parts. The first is the analysis for minimization of the temperature distortion due to the thermocouple cavity. The error is mimimized or reduced to zero by optimizing a combination of cavity diameter and depth and the thermocouple material and size. The second is the refinement of the presently available computer programs for prediction of the surface temperature and heat flux at the inner surface of the pipe by inverting the temperature measured by an interior probe close to the heated surface. The refinement is achieved by using the double precision format in the program and adapting the dimensionless formulation. The third is to study the inversion solution for a large time duration of a time dependent surface heat flux. The solution is obtained by the method of Laplace transform and the convolution integral. Each of the above three subjects is reported as a part of the present report. GRA

N77-25465# Stanford Univ., Calif. Dept. of Computer Science.
THEORETICAL AND PRACTICAL ASPECTS OF SOME INITIAL BOUNDARY VALUE PROBLEMS IN FLUID DYNAMICS
Joseph Oliger and Arne Sundstroem (Natl. Defense Res. Inst., Stockholm) Nov. 1976 65 p refs
(Contract N00014-75-C-1132; Grant NSF DCR-75-13497)
(AD-A035219; SU-STAN-CS-76-578) Avail: NTIS HC A04/MF A01 CSCL 12/1

Initial-boundary value problems for several systems of partial differential equations from fluid dynamics are discussed. Both rigid wall and open boundary problems are treated. Boundary conditions are formulated and shown to yield well-posed problems for the Eulerian equations for gas dynamics, the shallow-water equations, and linearized constant coefficient versions of the incompressible, anelastic equations. The primitive hydrostatic meteorological equations are shown to be ill-posed with any specification of local, pointwise boundary conditions. Analysis of simplified versions of this system illustrates the mechanism responsible for ill-posedness. Author (GRA)

N77-25466# Naval Weapons Center, China Lake, Calif.
FLUID DYNAMIC ANALYSIS OF HYDRAULIC RAM 4. (USER'S MANUAL FOR PRESSURE WAVE GENERATION MODEL) Final Report, Jul. 1972 - Dec. 1974
E. A. Lundestrom and W. K. Fung Oct. 1976 82 p refs
(AD-A033462; JTCG/AS-74-T-018) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report presents a theory for modeling the pressure wave generated by a penetrating projectile in fluid. Assumptions and limitations of the model are discussed. The computer program and sample problem listing also are presented. GRA

N77-25467# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
THE DISTURBANCE PRODUCED BY AN OSCILLATORY PRESSURE DISTRIBUTION IN UNIFORM TRANSLATION ON THE SURFACE OF A LIQUID
Allen H. Magnuson Aug. 1976 41 p refs
(AD-A032467; SPD-722-01) Avail: NTIS HC A03/MF A01 CSCL 20/4

The current development of air cushion supported marine vehicles has kindled a renewed interest in the analysis of water waves produced by surface pressure distributions. Recently, unsteady problems have been investigated in order to obtain insight into various aspects of the dynamic performance of air cushion supported vehicles. The problem treated in this paper is

closely related to the translating submerged source of pulsating strength. Presented is an entirely analytical result for the two-dimensional surface elevation that is valid for the entire field. Results are given for both a delta function and a uniform pressure distribution. GRA

N77-25468# Old Dominion Univ., Norfolk, Va. Inst. of Oceanography.
THE CONTINUOUS SPECTRUM OF THE ORR-SOMMERFELD EQUATION. PART 1: THE SPECTRUM AND THE EIGENFUNCTIONS Interim Report, 1 Aug. 1975 - 31 Jul. 1976
Chester E. Grosch and Harold Salwen (Stevens Inst. of Technol., Hoboken, N. J.) Sep. 1976 51 p refs
(Contract N00014-75-C-0777; ARPA Order 2924)
(AD-A035381; TR-33) Avail: NTIS HC A04/MF A01 CSCL 20/4

It is shown that the Orr-Sommerfeld equation governing the stability of any mean shear flow in an unbounded domain which has finite energy under some Galilean transformation has a continuous spectrum. This result applies to both the temporal and spatial stability problems. Formulae for the location of this continuum in the complex wave speed plane are given. The continuous spectrum and corresponding eigenfunctions are calculated for two samples problems: the Blasius boundary layer, and the two-dimensional laminar jet. The nature of the eigenfunctions, which are very different from the Tollmien-Schlichting waves, are discussed. Three mechanisms are proposed by which these continuum modes could cause transition in a shear flow while bypassing the usual linear Tollmien-Schlichting stage. GRA

N77-25469# Bell Telephone Labs., Inc., Whippany, N.J.
THE ORIGIN OF CUSPED WAVES IN LAYERED FLUIDS Final Report
Gary S. Deem 20 Jul. 1976 51 p refs
(NR Proj. 062-538)
(AD-A033185) Avail: NTIS HC A04/MF A01 CSCL 20/4

We establish conditions for the appearance of nonlinear 'cusped waves' in density layered shear flows by means of computer simulations with a model set of initial mean density and shear velocity profiles. These waves occur when a region with gradient Richardson number Ri = 1/4 is initially confined between regions where Ri - 1/4. In other cases a closed-circulation, 'cat's eye' pattern develops. Buoyancy forces dominate in the nonlinear evolution of cusped waves, whereas Reynolds shear stresses dominate in the development of cat's eyes. Cusped waves continue to extract energy from the mean shear approximately linearly in time, whereas cat's eyes have bounded energy content. Indirect evidence is presented for the existence of cusped wave instabilities in the ocean. Author (GRA)

N77-25470# Princeton Univ., N. J. Gas Dynamics Lab.
OBLIQUE SHOCK WAVE/TURBULENT BOUNDARY LAYER INTERACTIONS IN THREE DIMENSIONS AT MACH 3, PART 1 Final Report, Jun. 1975 - Jan. 1976
B. Oskam, I. E. Vas, and S. M. Bogdonoff Jun. 1976 173 p refs
(Contract F33615-75-C-3126)
(AD-A033386; AFFDL-TR-76-48-Pt-1; Rept-1292) Avail: NTIS HC A08/MF A01 CSCL 20/4

An experimental study, thoroughly documenting the flow field and surface data resulting from the three-dimensional interaction of a shock wave, a shock generator and a high Reynolds number turbulent boundary layer, is described. Detailed surface static pressure data and heat transfer measurements are presented for 7 shock generator deflection angles ranging from 2 to 14 deg. in 2 deg. increments. The test conditions consist of a free stream Reynolds number per inch of 1.6 million, a near adiabatic wall temperature and ambient stagnation temperature. In addition to the surface data, detailed flow field surveys have been conducted of time-averaged variables including flow angularity, pitot pressure, static pressure and total temperature at 2 shock generator deflection angles of 4 and 10 degrees. Detailed discussions of the experimental techniques are given which include a complete set of error estimates of the various types of data. Finally the data are presented in graphical form which may be used to analyze the problem under consideration. Author (GRA)

N77-25471# Flow Research, Inc., Kent, Wash.
THE EFFECTS OF FINITE-AMPLITUDE DISTURBANCES ON THE MEAN FLOW PROFILES IN A LAMINAR BOUNDARY LAYER
C. L. Merkle, D. R. S. Ko, and T. Kubota Oct. 1976 44 p refs Sponsored in part by Physical Dynamics, Inc., Detroit
(Contract N00014-76-C-0528)
(AD-A032434; Flow-Res-74) Avail: NTIS HC A03/MF A01 CSCL 20/4

Recent advances in boundary layer control technology have greatly enhanced the feasibility of designing a high speed, high performance, laminar-flow vehicle. The potential improvement of the vehicle performance through the use of boundary-layer control depends strongly on the ability to understand the physics of the transitional and pre-transitional boundary layer and to use this understanding to predict and control the occurrence and location of boundary-layer transition. To date, empirical correlations of the location of transition have been the most commonly used schemes in most design procedures. This report specifically addresses this problem of improving the present capability for predicting the transition onset analytically. GRA

N77-25472# Martin Marietta Corp., Baltimore, Md.
SEPARATION OF THREE-DIMENSIONAL FLOW
K. C. Wang Aug. 1976 80 p refs
(Contract F49620-76-C-0004)
(AD-A033569; MML-TR-76-54C) Avail: NTIS HC A05/MF A01 CSCL 20/4

Separation patterns of three-dimensional flow are discussed here, partly on the basis of limited calculated results, but mostly on experimental observations and intuition. Generally the separation pattern is rather independent of whether the boundary layer is laminar or turbulent and whether the flow is incompressible or hypersonic. The difference is in degree, not character. Various three-dimensional separation criteria are reviewed and the open-vs-closed separation idea, particularly, is presented in detail. The bulk of this work is divided into three parts, dealing with the separation over elongated inclined bodies, airplane wings at incidence, and around the corners between intersecting bodies. GRA

N77-25473# City Univ. of New York.
THE STABILITY OF PLANE COUETTE FLOW Interim Report
Terence Coffee 1976 71 p refs
(Grant AF-AFOSR-2063-71)
(AD-A032740; AFOSR-76-1210TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

The effect of small disturbances on laminar plan Couette flow is stuided. If the disturbances are infinitesimal, the effects are described by the Orr-Sommerfeld equation. Chebyshev polynomials are used to reduce using the generalized Rayleigh quotient, which involves substantially less computer time than previous methods. Accurate eigenvalues are then computed for higher values of the parameters than have been done previously. These values further confirm the belief that Couette flow is stable under infinitesimal disturbances. Using the linear results as a starting point, the effect of finite disturbances is studied. A system of equations is derived for the Navier-Stokes equations, taking into account non-linear terms. In this case, the flow becomes turbulent for certain values of the parameters. Author (GRA)

N77-25474# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Ground Equipment/ Materials Directorate.
ROCKET EXHAUST FLOW IN TUBE LAUNCHERS
James L. Batson 19 Jan. 1976 114 p refs
(DA Proj. 1M3-62303-A214)
(AD-A035051; RL-76-12) Avail: NTIS HC A06/MF A01 CSCL 20/4

The present investigation, which was primarily of an experimental nature, was undertaken to define the flow field produced when an underexpanded jet is exhausted from a conical nozzle (Rocket exhaust) into a cylindrical tube (tube launcher). The experimental data included the reservoir conditions for the

nozzle, the static pressure distribution along the cylinder wall, pilot probe surveys at the cylinder exit, and photographs of the flow exhausting from the tube. Of principal concern were the effects on the flow-field of tube length, of reservoir conditions, and of test time. Although room-temperature nitrogen was used as the test gas in most of the tests, several tests used actual rockets statically fired into the same cylindrical tubes. The experimentally determined flow field characteristics were compared with the experimental data of others, with a method of characteristics analysis developed for the present investigation, and with the flow field model of Fabri and Siestrunck.
Author (GRA)

N77-25475# Illinois Inst. of Tech., Chicago. Dept. of Mechanics Mechanical and Aerospace Engineering.
GENERATION, MEASUREMENT AND SUPPRESSION OF LARGE SCALE VORTICITY IN INTERNAL FLOWS Interim Technical Report, 1 Jul. 1974 - 1 Jun. 1976
R. A. Wigeland, M. Ahmed, and H. M. Nagib Aug. 1976 25 p refs
(Grant DAHC04-74-G-0160)
(AD-A035058; R76-5; ARO-ITR-76-2; ARO-12290.2-E) Avail: NTIS HC A02/MF A01 CSCL 20/4

The main objectives are not only to develop recommended procedures for control of large scale swirling and secondary flows, but also to extract from empirical observations general concepts which design and test engineers could adapt for 'tailoring and manipulating' their own special flows with different rotational characteristics. Several typical rotational flows were generated and superimposed on the flow through the test section. Careful calibration was carried out using hot-wire anemometers, and miniature vane-vorticity indicators. These flows represent the basic target conditions to be controlled by inserting various flow manipulators: honeycombs, screens and perforated plates. Comparison of the characteristics of the flow downstream of the manipulators (e.g., distribution of streamwise vorticity) to the original test flows provides a measure of the efficacy of the manipulators in suppressing large scale vorticity as well as clues to dominant mechanisms of the flow transformations. GRA

N77-25476# ARO, Inc., Arnold Air Force Station, Tenn.
NUMERICAL ANALYSIS OF TURBULENT SEPARATED SUBSONIC DIFFUSER FLOWS Final Report, Oct. 1973 - Jun. 1976
J. C. Chien AEDC Feb. 1977 158 p refs Sponsored by the Air Force
(AD-A036005; ARO-ETF-TR-76-122; AEDC-TR-76-159) Avail: NTIS HC A08/MF A01 CSCL 01/1

A general finite difference formulation of the incompressible Navier-Stokes equations in terms of the vorticity and the stream function is presented for turbulent internal flows. Turbulent models such as algebraic eddy viscosity models, and the low Reynolds number two-equation k-epsilon models were systematically studied. Numerical solutions are presented for both separated and non-separated subsonic diffuser flows with either a sublayer coordinate stretching or a low of the wall matching procedure. Excellent agreement with experimental data is obtained for the fully developed channel flow. Agreement with data from an 8-deg conical diffuser is also good. The detailed flow-field structure for separated diffuser flows can be obtained including the prediction of the separation point. Author (GRA)

N77-25477# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
SHOCK WAVE PENETRATION AND LATERAL PRESSURE GRADIENT EFFECTS ON TRANSONIC NORMAL SHOCK-TURBULENT BOUNDARY LAYER INTERACTIONS Interim Technical Report
G. R. Inger Dec. 1976 29 p refs
(Contract N00014-75-C-0456)
(AD-A035573; VPI-Aero-060) Avail: NTIS HC A03/MF A01 CSCL 20/4

The titled affects, which are usually neglected in contemporary theories of viscous-inviscid interaction, are here examined in detail for the unseparated transonic turbulent case. They are found to be significant in many respects. In particular, our results suggest that neglect of shock penetration becomes very inaccurate in the supersonic separated flow regime, leading to substantial underestimates of the local interact strength and its overall streamwise extent. Author (GRA)

N77-25478# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div
PRODUCTION SUITABILITY OF AN ELECTROFORM CONDUCTIVE WAX PROCESS FOR THE MANUFACTURE OF FLUIDIC SYSTEMS. PHASE 2 Final Report, Feb. 1975 - Mar. 1976
Walter Posingies Jan. 1977 119 p
(Contract DAAJ02-74-C-0012)
(AD-A035173; GAPD-2760-47021; USAAMRDL-TR-76-42) Avail: NTIS HC A06/MF A01 CSCL 09/5

This document presents the results of Phase 2 of a three-phase program to determine and demonstrate the production suitability of the Electroform Conductive Wax process in conjunction with conventional production processes for the manufacture of fluidic systems. During Phase I, an integrated amplifier-manifold hydrofluidic stability augmentation system, using the Electroform Conductive Wax process was successfully designed, fabricated, and qualification tested, and a pilot production line using the Electroform Conductive Wax process was defined. GRA

N77-25479# Advanced Technology Center, Inc., Dallas, Tex.
HYDRODYNAMIC DRAG OF DISKS WITH COMPLIANT MEMBRANE/SUBSTRATE FACES Interim Report
T. D. Reed Jan. 1977 77 p refs
(Contract N00014-69-C-0214)
(AD-A035865; ATC-B-94300/7CR-1) Avail: NTIS HC A05/MF A01 CSCL 20/4

A disk with interchangeable faces of compliant membrane/substrate combinations was spin-tested in a water tank. A device for stretching a membrane uniformly and with repeatable results was designed, fabricated, and successfully employed. Six membrane materials and three substrate materials were utilized to fabricate over 36 different compliant disks. Each of these was tested in turbulent flow over a Reynolds number range 1.77-2.95 x 10 to the 6th power. A maximum drag reduction of 19% is indicated from tests with a heavy polyurethane membrane unbounded to an organic rubber substrate. This amount of drag reduction is inferred from data taken with polyurethane sheet material which had a rough surface finish. Thus, additional tests with smooth polyurethane membranes are needed to verify the reported drag reductions. The present results tend to follow Ash's membrane frequency criterion, other data for similar membranes suggest this criterion may be a necessary but not sufficient condition. It is recommended that future exploratory studies of the hydrodynamic drag reduction potential of membrane walls be done with flat plates in order to facilitate more detailed flow measurements. GRA

N77-25480# Naval Postgraduate School, Monterey, Calif.
TRANSVERSE FORCES ON ROUGH CYLINDERS IN HARMONIC FLOW M.S. Thesis
Peter John Henning Mar. 1977 51 p refs
(AD-A035851) Avail: NTIS HC A04/MF A01 CSCL 20/4

The transverse forces acting on smooth and sand-roughened circular cylinders immersed in an harmonically oscillating flow have been measured using a recently constructed U-shaped water tunnel. The lift coefficients were found to depend on Keulegan-Carpenter number but independent of the Reynolds number within the range of relative roughness and Reynolds numbers tested. The results have shown that the lift coefficients for smooth cylinders at low Reynolds numbers are nearly identical with those obtained for rough cylinders at very high Reynolds numbers at the corresponding amplitude ratios. GRA

N77-25481# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
LAMINARISCENT TURBULENT BOUNDARY LAYERS: EXPERIMENTS ON NOZZLE FLOWS
Roger L. Simpson and C. R. Shackleton Jan. 1977 105 p refs Prepared by Southern Methodist Univ., Dallas
(Contract N00014-75-C-1143; Proj. SQUID; NR Proj. 098-038)
(AD-A037441; SQUID-SMU-2-PU) Avail: NTIS HC A06/MF A01 CSCL 20/4

Because a turbulent boundary layer in a nozzle undergoes strong acceleration, a laminariscent boundary layer with the benefit

of a lower surface heat transfer rate can result for some short distance. Here several phenomena which accompany laminarescence, produced by strong acceleration are examined for nozzle-flow and sink-flow accelerational distributions, respectively. GRA

N77-25482# JAYCOR, Del Mar, Calif.
A BALANCED EXPANSION TECHNIQUE FOR CONSTRUCTING ACCURATE FINITE DIFFERENCE ADVECTION SCHEMES
Robert K.-C. Chan Feb. 1977 51 p
(Contract N00014-76-C-0455)
(AD-A035698; J77-75008-TR-1) Avail: NTIS HC A04/MF A01 CSCL 12/1

A new procedure, called the Balanced Expansion Technique (BET), is employed to construct accurate finite difference advection schemes that, for the model equation considered, are neutrally stable. By applying BET systematically, the phase error can be made as small as one wishes. Test calculations with one-dimensional problems have confirmed the expected accuracy of these methods. Author (GRA)

N77-25483# California State Univ., Long Beach. Dept. of Mechanical Engineering.
SEPARATED FLOWS AND THEIR REPRESENTATION BY BOUNDARY-LAYER EQUATIONS Final Report, Jan. 1975 - Sep. 1976
Tuncer Cebeci Sep. 1976 40 p refs
(Contract N00014-75-C-0607)
(AD-A035693; ONR-CR215-234-2) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report presents an efficient numerical method for computing laminar and turbulent boundary layers with and without separation. It represents a major extension to the earlier work described by the author and makes use of Keller's two-point finite-difference method to solve the governing equations. The nonlinear eigenvalue approach of the earlier work was found to be inappropriate to the separating boundary layers which are the main concern of this report and an alternative-approach, based on the solution procedures of Cebeci and Keller has been used. The solutions, which relate to attached and separating flows, were obtained with prescribed distributions of displacement thickness. Author (GRA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-25484 British Library Lending Div., Boston Spa (England).
CONSIDERATIONS OF THE DIFFERENT TYPES OF ZEROS AND THE ASYMMETRY OF A COMPENSATION PYROHELIOMETER
D. Crommelynck 1973 15 p refs Transl. into ENGLISH from Inst. Roy. Met. Belgique, Miscell. Ser. A. (Brussells), no. 3, 1973 15 p
(BLL-M-24822-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The type of zero to use for pyroheliometric measurements was considered. It was concluded that a controversy regarding the choice of zero has no significance for an instrument where zeros are not absolute. The reduction of measurements obtained with the help of methods more or less fixed cannot modify any error in the measurements if the different zeros are not identical within the limits of the desired resolution. The use of asymmetry factors cannot improve any measurement error which is due to an incorrect definition and inadequacy of the radiometer. Asymmetry factors can nevertheless be considered in classifying the quality of a radiometer. D.M.L.

N77-25485 British Library Lending Div., Boston Spa (England).
DETERMINATION OF LOW ACTIVITIES OF U-Ra-SERIES ELEMENTS BY A LIQUID-SCINTILLATION SPECTROMETER
H. Prochazka and R. Jilek Aug. 1976 9 p refs Transl. into ENGLISH from Jaderna Energie (Prague), v. 17, no. 4, 1971 p 117-120
(BLL-SMRE-Trans-6562-(8313.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The use of a liquid scintillation spectrometer for the determination of naturally occurring uranium, radium, lead, and polonium in aqueous solutions and in biological materials is described. The method of simple preparation of the samples is presented as a practical example of the quantitative and qualitative evaluation of the results of measurements and generally valid principles of analysis. The method is suitable both for the investigation of the pollution of waste waters and for establishing the activity of the ash of biological tissues. Author

N77-25486*# Lumin, Inc., Tuscaloosa, Ala.
A THEORETICAL ANALYSIS OF THE MSFC HOLOGRAPHIC CORRELATION SYSTEM Final Report
Hua-Kuang Liu 31 May 1977 21 p refs
(Contract NAS8-31746)
(NASA-CR-150283; Rept-122-77) Avail: NTIS HC A02/MF A01 CSCL 14E

A theoretical analysis was completed for the correlation output signal for the MSFC holographic correlation filtering system. Under appropriate assumptions, the correlation output was derived as a function of the roughness of the tested surface, the displacement of the illuminated area of the test surface, the characteristics of the optical components used in the system, and the system configuration. In addition, an approximate relationship between the displacement of the detected signal (which is focused on the photomultiplier tube) and the displacement of the illuminated area on the test surface was also derived. Author

N77-25487*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MINIATURE DRAG-FORCE ANEMOMETER
Lloyd N. Krause and Gustave C. Fralick Washington Jun. 1977 26 p refs
(NASA-TM-X-3507; E-9087) Avail: NTIS HC A03/MF A01 CSCL 14B

A miniature drag-force anemometer is described which is capable of measuring dynamic velocity head and flow direction. The anemometer consists of a silicon cantilever beam 2.5 mm long, 1.5 mm wide, and 0.25 mm thick with an integrated diffused strain-gage bridge, located at the base of the beam, as the force measuring element. The dynamics of the beam are like those of a second-order system with a natural frequency of about 42 kHz and a damping coefficient of 0.007. The anemometer can be used in both forward and reversed flow. Measured flow characteristics up to Mach 0.6 are presented along with application examples including turbulence measurements. Author

N77-25488# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
VERY-WIDE-FIELD CAMERA. PROPOSAL OF SPACE ASTRONOMY LABORATORY FOR SECOND SPACELAB MISSION
Georges Courtes, Principal Investigator, Maurice Viton, Jean-Pierre Sivan, and Harry Atkins (NASA, Marshall Space Flight Center) 9 Nov. 1976 57 p refs
(LAS-CGC-14-76) Avail: NTIS HC A04/MF A01

A proposal is made for inclusion of a very wide field camera onboard Spacelab. Its scientific program is outlined: detection and photometry, spectrography, and star and starlike object photography. The optics, receptor, and mechanical structure are described. Scientific and technical constraints are discussed, and a development plan is detailed. The dust contamination of Spacelab using the camera was also studied. ESA

N77-25489# Universite des Sciences et Techniques de Lille (France). Inst. de Mecanique des Fluides. Ultra-Rapide.
HIGH SPEED CHRONOPHOTOGRAPHY STUDY OF TRANSONIC TURBULENT FLOW [ETUDE D'ECOULEMENTS TRANSSONIQUES TURBULENTS PAR CHRONOPHOTOGRAPHIE]

A. Dyment and P. Gryson 1976 41 p refs In FRENCH Presented at 13th Colloq. d'Aerodynamique Appl., Ecully, France, 8-10 Nov. 1976
Avail: NTIS HC A03/MF A01

The experiments described consist essentially of shadowgraph and streak photography, using separate or a series of flashes, of various flows showing shedding and formation of turbulent wakes. The interpretation of the observations is relevant to the knowledge of the unsteady aspect of turbulent flows concerning mainly the formation of large turbulent structures, their propagation, their diffusion, the formation of alternate streams, their evolution, their frequency, interactions with several vortex streets, and the appearance of intermittent phenomena. Examples of wing profile flows are presented. ESA

N77-25490# Interuniversitair Reactor Instituut, Delft (Netherlands).
SOME CONSIDERATIONS FOR FUTURE INSTRUMENTATION AND SOFTWARE DEVELOPMENTS IN N.A.A.
M. DeBruin, P. J. M. Korthoven, and J. P. W. Houtman 1976 9 p refs Presented at the Intern. Conf. on Modern Trends in Activation Analy., Munich, 13-17 Sep. 1976
(IRI-133-76-12) Avail: NTIS HC A02/MF A01

The possibilities of improving sensitivity, precision, and accuracy of neutron activation analysis are surveyed. The necessary technology, such as well-type Ge(Li) detectors and low energy photon detectors, is available but leads to a cost increase. The use of computer facilities is considered, as are irradiation facilities and standard preparation. ESA

N77-25491# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
A MICROWAVE VECTOR VOLTMETER SYSTEM
Keith C. Roe and Cletus A. Hoer Aug. 1976 70 p refs Sponsored by AF
(PB-264300/5; NBSIR-76-844) Avail: NTIS HC A04/MF A01 CSCL 14B

A system discription and operating procedure for a vector voltmeter system which covers the frequency range .5 to 12 GHz is presented. The design is based upon a seven port junction where phase and amplitude information is obtained using only power detectors. The system is computer controlled and self-calibrating for ratio measurements. GRA

N77-25492# National Inst. for Occupational Safety and Health, Morgantown, W. Va. Testing and Certification Lab.
INDUSTRIAL SOUND LEVEL METER ACOUSTICAL CALIBRATOR ACCURACY TEST
Ronnie L. Fortner Jun. 1976 25 p refs
(PB-262621/6; NIOSH/TC/P-008) Avail: NTIS HC A02/MF A01 CSCL 14B

The test procedure checks, under minimal supply voltage conditions, the frequency and sound pressure level accuracy of an acoustical calibrator of an Industrial Sound Level Meter Set. GRA

N77-25493# Washington State Univ., Pullman. Dept. of Physics.
SHOCK COMPRESSION OF BIMETALLIC JUNCTIONS Final Report, 1 Nov. 1975 - 31 Oct. 1976
George E. Duvall, Douglas Bloomquist, and Jerry J. Dick 29 Dec. 1976 12 p refs
(Grant AF-AFOSR-2898-76)
(AD-A035570; AFOSR-77-0056TR) Avail: NTIS HC A02/MF A01 CSCL 20/3

The response of bimetallic junctions to shock loading was investigated using a new simplified geometry in which the circuit of interest is completed by impact. Techniques for measuring the 1 millivolt level signals were developed within this geometry with the extensive use of null experiments in which both parts of the junction were of the same material. It was shown that the use of a ferromagnetic material introduces a demagnetization signal that is not well characterized, which puts measurements of thermal E. M. F.s measured in nickel under shock loading conditions in some doubt. Results of experiments involving a nickel 80 percent chromium 20 percent alloy indicate that the E. M. F.s involved are anomalously high, in agreement with previous work done elsewhere. The dependence of the thermal E. M. F.s generated on the geometry or the assumptions of one-dimensional conditions has not been completely characterized but the indication is that there is indeed some dependence. Author (GRA)

N77-25494# Army Engineer Topographic Labs., Fort Belvoir, Va.
POINT LIGHT SOURCE CONTACT PRINTER PHOTOGRAPHIC TECHNOLOGY SERIES
Gunther Schwarz Sep. 1976 15 p refs
(AD-A035098; ETL-0084) Avail: NTIS HC A02/MF A01 CSCL 14/5

This report describes the point light source contact printer built in-house and the exposure characteristics of the light source. Tests performed in the printer were to determine uniformity and repeatability of the exposure. Author (GRA)

N77-25495# Naval Undersea Center, San Diego, Calif.
COMPUTER-GENERATED HOLOGRAMS Research Report, Feb. - Nov. 1976
Norman Pos Dec. 1976 47 p refs
(AD-A035927; NUC-TP-546) Avail: NTIS HC A03/MF A01 CSCL 09/2

Synthetic binary computer-generated holography is used to produce the volumetric image reconstruction of real or artificial data fields. Author (GRA)

N77-25496# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
IMPROVED MILLIVOLT-TEMPERATURE CONVERSION
P. E. Stallman and K. Itagaki Dec. 1976 69 p refs
(AD-A034841; CRREL-SR-76-18) Avail: NTIS HC A04/MF A01 CSCL 14/2

It is the intent of the report to extend and improve the tables already available (CRREL Special Report 108, G.W. Aitken, 1966). The computational method is described with discussion of error improved methods, and limitations. The tables are presented in two sections: the first for temperatures in the range -184C to 0C, the second for temperatures in the range 0C to 100C. The corresponding Fahrenheit temperatures are also included. GRA

N77-25497# Army Engineer Topographic Labs., Fort Belvoir, Va.
MATERIALS RESEARCH FOR HOLOGRAPHIC RECORDING. REPORT NUMBER 1: MULTIPLE IMAGE STORAGE OF CONTINUOUS TONE DATA IN VOLUME HOLOGRAMS
John W. Eastes Jul. 1976 23 p refs
(AD-A035457; ETL-0088) Avail: NTIS HC A02/MF A01 CSCL 14/5

This report describes tests and evaluation of 649-F plates for recording and storing multiple encoded continuous tone images for optical memories and display devices. Using this plate, up to 9 separate continuous tone images have been superimposed in a single location. Applications to graphical data storage and retrieval devices are discussed. Author (GRA)

N77-25498# RCA Labs., Princeton, N. J.
MATERIALS FOR VOLUME PHASE HOLOGRAPHY Final Report, 8 Oct. 1975 - 7 Oct. 1976
William Phillips, William J. Burke, and William J. Staebler Dec. 1976 57 p refs
(Contract N00019-76-C-0116)
(AD-A035676; PRRL-76-CR-57) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report describes work on single-crystal LiNbO3 Fe for volume holographic information storage. The purpose was to determine if increased rates of fixing of holograms could be obtained by codoping the crystals with Si. The conclusion is that the addition of Si to the crystal may indeed increase the fixing rate. However, large amounts of Si are required to produce the effect, and under these conditions it appears that it will be extremely difficult to obtain higher crystal quality. The authors believe that the material of choice for high density read-only information storage is LiNbO3 single-doped with Fe. Up to 1,000 high resolution holograms can be stored in a 6-cc crystal. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-25499* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
LENGTH CONTROLLED STABILIZED MODE-LOCK ND:YAG LASER Patent
John Sigfred, inventor (to NASA) (NAS-NRC) Issued 24 May 1977 6 p Filed 5 Jan. 1976 Supersedes N76-17384 (14 - 08, p 0978) Sponsored by NASA
(NASA-Case-GSC-11571-1; US-Patent-4,025,875; US-Patent-Appl-SN-646704; US-Patent-Class-331-94.5S) Avail: US Patent Office CSCL 20E

A method and apparatus for stabilizing the amplitude and repetition rate of mode-locked Nd:YAG laser pulses by controlling the laser length through a feedback loop are described. The end mirror of the laser is mounted on a piezoelectric crystal which is dithered at a low frequency. A portion of fundamental 1.06 micrometer laser radiation is converted into its second harmonic frequency, and the average power of the second harmonic frequency is detected by an integrating detector. The amount of the power of the second harmonic frequency depends on the match between the optical length of the laser cavity and the mode-lock frequency. The length is controlled by a feedback loop which phase compares the output of the second harmonic detector to the piezoelectric crystal dither signal.
Official Gazette of the U.S. Patent Office

N77-25500 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF A CW HCN LASER DISCHARGE, OPTIMIZATION OF PARAMETERS AND SCALING LAWS: CONSTRUCTION AND APPLICATIONS
T. Belland, D. Veron, and L. B. Whitbourn Oct. 1976 18 p refs Transl. into English from J. de Phys. Suppl. (Paris), v. 36, no. 11, 1975 6 p
(BLL-CTO-1272-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Means of increasing the output power per unit volume for discharge excited mixtures of nitrogen, methane and helium in a CW HCN laser were investigated. It was found that maximum power increases with decreasing tube diameter up to a limit imposed by increasing diffraction losses. It was also found that the pyrex discharge tube may be used as a dielectric waveguide thereby reducing these losses and increasing the power to volume ratio of the laser. Scaling laws for CW waveguide HCN lasers were deduced from these results, and a 5 cm diameter laser with a 2 m long discharge and an output power of 100 mW was constructed. Technical problems relating to reliability and power stability were solved. The modes of the 100 mW waveguide laser were studied using a liquid crystal camera. Experimental methods were developed for measuring the electron density of the laser plasma, the gain coefficient, and the cavity losses. These methods could be applied to other submillimeter lasers.
Author

N77-25501* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PSEUDO-BACKSCATTER LASER DOPPLER VELOCIMETER EMPLOYING ANTIPARALLEL-REFLECTOR IN THE FORWARD DIRECTION Patent
William D. Gunter, Jr., inventor (to NASA) Issued 31 May 1977 8 p Filed 27 May 1976 Supersedes N76-24530 (14 - 15, p 1929)
(NASA-Case-ARC-10970-1; US-Patent-4,026,655; US-Patent-Appl-SN-691046; US-Patent-Class-356-28; US-Patent-Class-250-574; US-Patent-Class-350-100; US-Patent-Class-350-102) Avail: US Patent Office CSCL 20E

A laser Doppler velocimeter for measuring the velocity of a flowing fluid was discussed. It comprises laser means for providing first and second beams of coliimated coherent monochromatic electromagnetic radiation which are focused to intersect at a predetermined location in a flowing fluid. The movement of the particles of the fluid serve to scatter radiation in substantially all directions. The scattered radiation is shifted in frequency from that of the first beam by an amount corresponding to the velocity of the fluid at the predetermined location. A corner cube is disposed generally forward of the predetermined location, the corner cube responding to a portion of the radiation scattered in the forward direction and being operative to reflect the portion in a direction substantially antiparallel to the forward direction.
Official Gazette of the U.S. Patent Office

N77-25502* National Aeronautics and Space Administration. Pasadena Office, Calif.
COMPACT PULSED LASER HAVING IMPROVED HEAT CONDUCTANCE Patent
Lien C. Yang, inventor (to NASA) Issued 31 May 1977 7 p Filed 21 Dec. 1972
(NASA-Case-NPO-13147-1; US-Patent-4,027,273; US-Patent-Appl-SN-317310; US-Patent-Class-331-94.5P; US-Patent-Class-330-4.3; US-Patent-Class-331-94.5D) Avail: US Patent Office CSCL 20E

A highly efficient, compact pulsed laser having high energy to weight and volume ratios is provided. The laser utilizes a cavity reflector that operates as a heat sink and is essentially characterized by having a high heat conductivity, by being a good electrical insulator and by being substantially immune to the deleterious effects of ultra-violet radiation. Manual portability is accomplished by eliminating entirely any need for a conventional circulating fluid cooling system.
Official Gazette of the U.S. Patent Office

N77-25503# Oregon Univ., Eugene. Dept. of Physics.
ELECTRON ACCELERATION BY INTENSE LASER RADIATION: A SURVEY
Paul L. Csonka 1976 20 p refs Presented at 2d Conf. on Interaction of Electrons with Strong Electromagnetic Field, Budapest, Hungary, 6 Oct. 1975
(Contract AT(45-1)-2041)
(RLO-2041-146; Conf-751087-2) Avail: NTIS HC A02/MF A01

Several potential methods of accelerating electrons using intense laser light are discussed. Two methods are emphasized: focus laser light on one spot, and use the intense field in the focal region to accelerate electrons; and concentrate laser light along the electron path of length 2L much greater than lambda.
ERA

N77-25504# California Univ., Livermore. Lawrence Livermore Lab.
TIME-DEPENDENT PROPAGATION OF HIGH-ENERGY LASER BEAMS THROUGH THE ATMOSPHERE, 2
J. A. Fleck, Jr., J. R. Morris, and M. D. Feit 18 May 1976 65 p refs Sponsored in part by Navy and Army
(Contract W-7405-eng-48)
(UCRL-52071) Avail: NTIS HC A04/MF A01

Various factors that can affect thermal blooming in stagnation zones are examined, including stagnation-zone motion, longitudinal air motion in the neighborhood of the stagnation zone, and the effects of scenario noncoplanarity. Of these effects, only the last offers any reasonable hope of reducing the strong thermal blooming that normally accompanies stagnation zones. The methods of treating nonhorizontal winds hydrodynamically and multipulse steady-state sources are discussed. Pulse self-blooming in the triangular pulse approximation is discussed in the context of both single and multipulse propagation. It is shown that self-blooming and multipulse blooming cannot be treated independently.
ERA

N77-25505# Battelle Columbus Labs., Ohio.
SURFACE DISCHARGE UV ARC SOURCES FOR LASER EXCITATION Final Report
R. E. Beverly, III, R. H. Barnes, and M. C. Wong 29 Oct. 1976 46 p refs
(Contract W-7405-eng-92)
(BMI-1960) Avail: NTIS HC A03/MF A01

Spectroscopic studies of the UV emission from surface-discharge sparks across Al2O3, BN, ZnO, ZrO2, BaTiO3, ZnO.Al2O3 and Cr2O3.Al2O3 substrates were performed in He, N2, CO2, Ar, SF6, and Ar + i-C3F7I gases at pressures of 1 to 10 atm. Considerable differences were found in the performance of the various substrates; the best result obtained was with a 2-cm gap Cr2O3.Al2O3 substrate which gave 6.20 +- 0.78 J

of UV radiated in the 2500 to 2900-A iodine-laser pumpband for a stored electrical energy of 66.2 J and circuit parameters C = 82.8 nF and V/L. ERA

N77-25506# Battelle Columbus Labs., Ohio.
SURFACE DISCHARGE UV ARC SOURCES FOR LASER EXCITATIONS Final Report
R. E. Beverly, III, R. H. Barnes, C. E. Moeller, and M. C. Wong 10 Jun. 1976 78 p refs
(Contract W-7405-eng-92)
(BMI-X-671) Avail: NTIS HC A05/MF A01

High-current surface-spark discharges were spectroscopically investigated as intense sources of soft-UV radiation for laser excitation. Particular emphasis was placed on the nominal pumpband of the iodine photodissociation laser, and absolute measurements of the radiated energies, energy densities, and electrical-to-optical conversion efficiencies under different experimental conditions were performed. Time-integrated and time-resolved spectroscopic techniques were employed with Al2O3- and BN-substrate sources having stainless steel electrodes separated by 1- to 10-mm gaps and immersed in high-pressure Ar, He, N2, SF6, and CO2 pure gases and typical highly-pressure-broadened iodine amplifier gas mixtures. ERA

N77-25507# Illinois Univ., Urbana-Champaign. Dept. of Nuclear Engineering.
RECOMBINATION PUMPED ATOMIC NITROGEN AND CARBON AFTERGLOW LASERS Ph.D. Thesis
Gary Wayne Cooper 1976 54 p refs
(Contract EY-76-S-02-2007)
(COO-2007-77) Avail: NTIS HC A04/MF A01

Microwave quenching experiments have shown conclusively that the afterglow lasers are being pumped directly by the recombination of electron-ion pairs. This result differs from the mechanisms previously proposed for these systems. Measurements comparing the relative sensitivity to the electron temperature of the neon to atomic nitrogen and carbon afterglow light infer that the recombination process pumping these lasers is collisional-radiative, allowing the recombining ions to be identified as N(+) and C(+). Since this process is highly compatible with nuclear-radiation generated plasmas, it is not unreasonable to infer that this process is also the pumping mechanism in the nuclear-excited, neon-nitrogen laser. ERA

N77-25508# Physical Sciences, Inc., Woburn, Mass.
INVESTIGATION OF INDUCED UNIMOLECULAR DECOMPOSITION FOR DEVELOPMENT OF VISIBLE CHEMICAL LASERS Quarterly Progress Report, 1 May - 1 Aug. 1976
L. G. Piper and R. L. Taylor Aug. 1976 24 p refs
(Contract E(11-1)-2920)
(COO-2920-1; PSI-TR-61) Avail: NTIS HC A02/MF A01

A number of interesting reactions of azides which potentially lead to electronic excitation have been identified. To evaluate the potential of azide chemistry for a short wavelength laser, an experiment is being designed to determine some of the critical, but unknown, information and data. ERA

N77-25509# General Electric Co., Philadelphia, Pa. Space Div.
THE 5-WATT COPPER VAPOR LASER STUDY Final Report
B. G. Bricks, T. E. Buczacki, T. W. Karras, R. S. Anderson, and C. E. Anderson 4 Aug. 1976 31 p refs Prepared for Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-13700) Avail: NTIS HC A03/MF A01

The results of a study program to produce a reliable 5-watt discharge-heated copper vapor laser for use in the laser isotope separation experiments are described. The techniques for scaling the laser power to 5 watts and for improved reliability and lifetime are discussed. The problem of reducing the level of noise generated by the pulsed laser discharge was addressed, and an appropriate housing for the laser head was designed and built. The results of this program suggest several promising directions of effort for further improvement of laser power and performance. ERA

N77-25510# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
A CO2-LASER INTERFEROMETER WITH DIRECT READ-OUT OF PHASE-SHIFT
C. A. J. Hugenholtz and B. J. H. Meddens Nov. 1976 12 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-76-100) Avail: NTIS HC A02/MF A01

A CO2-laser interferometer with heterodyne detection was built to measure electron densities integrated over the optical path through a plasma in the range of 3 X 10 to 19th power/sq m to 3 X 10 to 23rd power/sq m. The heterodyne detection was accomplished at an intermediate frequency of 300 kHz. A digital phase comparator was used to obtain direct density read-out. The time solution is 10 microsec. With this interferometer it is possible to determine the increasing or decreasing character of fluctuations in the density. Author (ESA)

N77-25511# Army Electronics Labs., Fort Monmouth, N. J.
RARE-EARTH PENTAPHOSPHATES FOR MINIATURIZED LASER APPLICATIONS
Thomas R. AuCoin, Abraham Schwartz, Melvin J. Wade, and John G. Gualtieri Feb. 1977 19 p refs Presented at West Point Army Sci. Conf., West Point, N. Y., 22-25 Jun. 1976
(AD-A036134; ECOM-4467) Avail: NTIS HC A02/MF A01 CSCL 20/5

Neodymium pentaphosphate (DPPN) has recently emerged as a new laser compound offering a considerable improvement in operating efficiency over existing materials. Up to thirty times more Nd can be incorporated than in Nd:yttrium aluminum garnet, without substantial fluorescence quenching, linewidth broadening, life-time reduction and optical degradation of the crystal. The evaluation and testing of NdPP lasers in prototype components using optical pumping has been hindered due to the limited size, availability and quality of the single crystals. Unique modifications of conventional solution growth techniques have been devised which have yielded the largest crystals (greater than 1 cm) of NdPP currently available. Ambient control, growth temperature, rare-earth oxide to phosphoric acid ratio, and seeding were found to greatly influence nucleation, growth rate and crystal quality. An as-grown crystal of NdPP containing 10 percent yttrium, 2.5 x 3.5 x2.2 mm thick, produced 0.24 watts of output power for 1.0 watt of absorbed power using longitudinal pumping with a repetitively pulsed argon laser; the conversion efficiency is approximately 24 percent. Author (GRA)

N77-25512# Naval Research Lab., Washington, D. C. Optical Sciences Div.
HEAT CONDUCTION IN THREE DIMENSIONS Interim Report
S. T. Hanley 6 Dec. 1976 27 p refs
(AD-A034950; NRL-8066) Avail: NTIS HC A03/MF A01 CSCL 20/5

An applications-oriented numerical solution to the heat diffusion equation in three dimensions, with local temperature dependence in the thermal parameters and including phase changes, has been developed. Comparisons with exact one-dimensional solutions and experimental data indicate better than 10% accuracy in predicting internal slab temperatures. Rapid thermalization of water-cooled mirrors under high power densities is predicted. Possible applications to work in thermal signatures or irradiated targets are suggested. Author (GRA)

N77-25513# Airborne Instruments Lab., Deer Park, N.Y.
WAVEGUIDE HF LASER Semiannual Report, 8 Dec. 1975 - 7 Jun. 1976
A. Stein Nov. 1976 43 p refs
(Contract N00014-76-C-0397; ARPA Order 1806)
(AD-A034092; AIL-C416-1) Avail: NTIS HC A03/MF A01 CSCL 20/5

A purely electrical activation mechanism for HF lasers was investigated, whereby HF molecules are vibrationally excited through inelastic electron collisions in a discharge plasma. The plasma is generated by a transverse discharge inside a 1 x 1 mm rectangular channel of 8 cm length filled with a mixture of HF and an inert diluent gas. To obtain the desired plasma condition auxiliary high energy electrons are injected into the plasma. Initial flourescence measurements for pulsed excitation

indicate that further increases in the excitation rate are necessary. The remainder of this program will be concerned with tow measures to enhance the excitation rate (1) stretching of the discharge pulse to attain better quantum energy storage, and (2) seeding of the plasma with hydrogen gas which transfers its excitation to the HF molecules. Author (GRA)

N77-25514# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.

LASER INDUCED DAMAGE IN OPTICAL MATERIALS: 1976. PROCEEDINGS OF 8TH ANNUAL SYMPOSIUM ON OPTICAL MATERIALS FOR HIGH POWER LASERS

Dec. 1976 414 p refs Conf. held at NBS, Boulder Colo., 13-15 Jul. 1976 Sponsored in part by American Society for Testing Materials, Philadelphia, Committee F-1, Defense Advanced Research Projects Agency and ONR, Arlington, Va., and ERDA, Washington, D. C.

(PB-262553/1; NBS-SP-462; LC-76-600074) Avail: NTIS HC A18/MF A01 CSCL 20E

Materials for use at 10.6 micrometers in mirror substrates, windows, and coatings are discussed. Techniques in film deposition, and advances in diamond turning of optics were described. The scaling of damage thresholds with pulse duration, focal area, and wavelength are discussed. GRA

N77-25515# Rome Air Development Center, Griffiss AFB, N.Y.

EXTINCTION OF DF LASER RADIATION DERIVED FROM OUTDOOR ATMOSPHERIC MEASUREMENTS

James W. Cusack Dec. 1976 36 p refs

(AF Proj. 1279)

(AD-A035473; RADC-TR-76-333) Avail: NTIS HC A03/MF A01 CSCL 20/5

Outdoor field measurements of the atmospheric transmission of four dominant DF laser lines are reported. The measurements were performed at the Advanced Optical Test Facility located at the Verona Test Annex of the Rome Air Development Center. The measurements were made with a pulsed DF laser which was used to transmit across a propagation path of 2,000 feet in length. Results are reported for the 2-1 P(8), 2-1 P(9), 3-2 P(8), and the 2-1 P(6) DF lines. The experimental results are analyzed and compared with the latest in laboratory measurements. Results indicate that in high humidity environments the differences between laboratory and field measurements become increasingly larger. Author (GRA)

N77-25516# Litton Systems, Inc., Morris Plains, N. J. Airtron Div.

PREPARATION OF RARE EARTH DOPED LASER MATERIALS AND Er, Tm, Ho: YLiF4 LASER RODS Final Report, 1 Nov. 1975 - 1 Nov. 1976

Roger F. Belt, Robert Uhrin, and Larry Drafall Jan. 1977 30 p refs

(Contract N00014-76-C-0770)

(AD-A035148) Avail: NTIS HC A03/MF A01 CSCL 20/6

This work describes two main activities in preparation of special materials for solid state lasers. The first portion is concerned with Ce3+, Eu2+, Yb2+ and Pr3+ doped hosts to examine possible lasing schemes in the green region based on d-f type lasing. Hosts were chosen with particular structures, coordination, and charge to obtain band fluorescence centered near 5000 A. The second portion was directed towards preparations of Er, Tm, Ho doped YLiF4 to examine further the lasing at 2.06 micrometers under Q-switching conditions. Ten new (3 x 30) mm laser rods were delivered to U. S. Army Electronics Command for testing. The compositions of these rods differed in the amount of Tm and Ho. Preparation of all fluoride compounds was from commercially available 5-9's purity oxides. Single crystal growth was achieved by top seeded solution in an HF atmosphere. GRA

N77-25517# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN ANALYSIS OF MODULATION TECHNIQUES FOR THE SIMULTANEOUS MEASUREMENT OF RANGE AND REFLECTANCE INFORMATION BY AN AIRBORNE LASER SCANNER M.S. Thesis

Robert Charles Chapuran Dec. 1976 101 p refs

(AD-A035291; GE/EE/76-18) Avail: NTIS HC A06/MF A01 CSCL 20/5

The performance of an airborne laser terrain mapper, which measures both slant range and reflectance, depends on the method used to modulate the output power of the laser. This study analyzes four possible modulation techniques for a direct-detection scanner which utilizes a semiconductor laser. The first technique is sinusoidal modulation of the laser output. Range performance is found to improve as the frequency of the modulating sinusoid is increased. The second technique modulates the laser output with a subcarrier which is a periodic FM chirp pulse. Range performance improves as the frequency deviation of the chirp is increased. However, this also increases the required detector bandwidth. The third technique modulates the laser with a subcarrier which is phase-modulated by a periodic pseudonoise (PN) code. GRA

N77-25518# General Research Corp., McLean, Va.

SENSOR MODULATION EFFECTS UPON LASER SIGNATURES Final Technical Report

J. L. Gilbert, P. J. Kramer, and W. N. Peters Griffiss AFB, N.Y. RADC Dec. 1976 167 p

(Contract F30602-75-C-0292; AF Proj. 6527)

(AD-A035880; RADC-TR-76-391; Rept-905-01-CR) Avail: NTIS HC A08/MF A01 CSCL 17/8

This study is an analysis of coherent sensor system observable effects which tend to obscure target properties of interest. The main effects studied are finite system resolution, speckle, shot noise, and atmospheric propagation. In addition to these effects, several scenarios were considered to provide realistic assessments of their effects on the performance of laser radar systems. Also included is an investigation of the feasibility of performing range-Doppler imaging using different lasers in the measurement of range and Doppler. The analysis was made to determine the existence and extent of any fundamental problem areas which would prohibit or seriously limit the use of this technique. Author (GRA)

N77-25519# Letterman Army Inst. of Research, San Francisco, Calif. Dept. of Biomedical Stress.

CHARACTERISTICS OF DAMAGE PRODUCED BY NON-CIRCULAR RETINAL LASER RADIATION Interim Report, 1 May - 31 Jul. 1976

Edwin S. Beatrice and David J. Lund Oct. 1976 20 p refs

(DA Proj. 3A7-62758-A-824)

(AD-A035878; LAIR-31) Avail: NTIS HC A02/MF A01 CSCL 06/18

A comparison of the appearance of retinal burns produced by slit laser radiation was made using the same optical apparatus for argon (514.5NM), neodymium (1060 NM), and ruby (694.3NM) lasers. The retinal changes produced by exposures to these slit images were elongated for laser exposures less than or equal to 12 ms. For longer exposure times, the retinal opacifications were circular in appearance. A partial explanation is presented based on the thermal conductivity of the retinal tissue. Author (GRA)

N77-25520# Letterman Army Inst. of Research, San Francisco, Calif. Dept. of Biomedical Stress.

OCULAR HAZARD OF THE GALLIUM ARSENIDE Final Report, 1 Jan. 1970 - 1 Jan. 1975

David J. Lund, Dolph O. Adams, and Charles Carver Oct. 1976 24 p

(DA Proj. 3A7-62758-A-824)

(AD-A035877; LAIR-30) Avail: NTIS HC A02/MF A01 CSCL 06/18

The Gallium Arsenide (GaAs) Semiconductor laser is finding application in many devices which subject human eyes to laser irradiation. This study evaluated a single diode laboratory device to determine an ED50 level in rhesus monkeys. The BCA 7610 GaAs laser diode used in this experimant was cooled to cryogenic temperature (77 K) to allow rapid pulsing, thus increasing average power enough to create retinal burns. GRA

N77-25521# University of Southern Calif., Los Angeles.

VIBRATION-TO-ELECTRONIC ENERGY TRANSFER FOR ELECTRONIC TRANSITION LASERS

Stephen R. Leone 30 Nov. 1976 23 p refs

(Contract N00014-76-C-0541; ARPA Order 2840)

(AD-A035065) Avail: NTIS HC A02/MF A01 CSCL 20/5

This research was undertaken to help in the development of more efficient and scalable visible and ultraviolet lasers. The goal of the project seeks to determine whether transfer of energy from high vibrational levels of diatomic molecules can occur to lasing electronic states and if this transfer can be used to produce visible-UV lasers. GRA

N77-25522# Avco-Everett Research Lab., Everett, Mass.
ELECTRON-BEAM SUSTAINER DISCHARGE STREAMERS AND ARCING Annual Report, 1 Dec. 1975 - 30 Nov. 1976
D. H. Douglas-Hamilton and S. A. Mani Nov. 1976 71 p refs
(Contract F44620-75-C-0025; AF Proj. 9752)
(AD-A035352; AFOSR-77-0043TR) Avail: NTIS HC A04/MF A01 CSCL 20/5

The electron beam sustainer method of generating a stable high pressure gas discharge is investigated theoretically and experimentally. The most important discharge instability in the non-self-sustaining discharge is the streamer; this is discussed and a model proposed for formation and propagation. Integration of streamer velocity over the discharge gap predicts arcing times. Experimental measurements of streamer behaviour in nitrogen discharge have been made, and these are compared with predictions. Author (GRA)

N77-25523# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
RESEARCH IN MATERIALS SCIENCE Final Technical Report, 1 Jun. 1975 - 30 Sep. 1976
N. J. Grant 30 Sep. 1976 504 p refs
(Contract N00014-75-C-1084; ARPA Order 2994)
(AD-A035345) Avail: NTIS HC A22/MF A01 CSCL 20/5

Contents: Optoelectronic materials and components; Miniaturized lasers and thin film modulators; Potassium tantalate niobate thin films for integrated Optics Applications; Energy transfer in sensitized rare earth lasers; Microwave surface resistance of superconducting alloys; Chemical synthesis using high temperature Lithium Vapor species. GRA

N77-25524# Hughes Research Labs., Malibu, Calif.
EXCIMER LASERS Final Technical Report, 1 Oct. 1974 - 15 Aug. 1976
A. Jay Palmer and L. D. Hess Dec. 1976 95 p refs
(Contract N00014-75-C-0081; ARPA Order 1807)
(AD-A035340) Avail: NTIS HC A05/MF A01 CSCL 20/5

The results of a theoretical and experimental program addressed to demonstrating the feasibility of a high-energy alkali-rare gas excimer/dimer laser are reported. The major theoretical accomplishments are the development of a detailed model for flashlamp pumping of all the alkali-xenon excimer/dimer systems and for discharge pumping of the potassium-xenon and potassium-argon systems. The models predict that laser oscillation is attainable under practical laboratory conditions on both the excimer and dimer bands of these systems. Major accomplishments of the experimental program are a measurement of the stimulated emission coefficient on the K-Xe excimer band during flashlamp pumping which was consistent with the model; the attainment of a 1 microsec, pulsed diffuse discharge through an aerosol-free K-Ar mixture under conditions predicted by the model to be sufficient for achieving laser oscillation on the excimer and dimer bands and the attainment of preliminary absolute fluorescence data on the discharge pumped K-Ar excimer band indicative of a resonance level concentration within an order of magnitude of that predicted by the model. Author (GRA)

N77-25525# Technion - Israel Inst. of Tech., Haifa.
MACROSCOPIC DESCRIPTION OF LASER-TYPE MATTER Annual Report, Aug. 1975 - Aug. 1976
I. R. Senitzky Sep. 1976 38 p refs
(Grant DA-ERO-75-G-012; DA Proj. 1T1-61102-B-31E)
(AD-A035746) Avail: NTIS HC A03/MF A01 CSCL 20/10

Specialization of the previously developed boson-second-quantization BSQ formalism for the description of cooperative atomic behavior to the case of a two-level laser allows comparison with and criticism of other theories of cooperative behavior. Application of the BSQ formalism to a model of a three-level laser leads to equations of motion in terms of macroscopic variables without the use of phenomenological modifications. These equations, which can easily be generalized to more than three levels, may be intepreted both classifically and quantum-mechanically, and offer the possibility of investigating a number of problems which are of both conceptual and practical interest. GRA

N77-25526# Army Electronics Command, Fort Monmouth, N. J.
A HIGHLY-STRESSED CYLINDRICAL ELECTRODE CARBON DIOXIDE (CO2) TRANSVERSELY EXCITED ATMOSPHERIC (TEA) LASER Final Technical Report
G. R. Osche and H. W. Sonntag Feb. 1977 24 p refs
(AD-A037386; ECOM-4468) Avail: NTIS HC A02/MF A01 CSCL 20/5

A cylindrical electrode scheme which utilizes a fine wire as the central electrode is investigated for compact carbon dioxide (CO2), transversely excited atmospheric (TEA) laser applications. It is found that the strong radial dependence of electrical energy deposition into the plasma, a consequence of the large ratio of outer to inner electrode radii, produces a radial gain profile which is well localized in the center of the discharge tube. This allows for efficient matching of low order stable modes to the active gain region while providing a high degree of mode selectivity in favor of these modes. Oscillation in the TEM(01) Laguerre-Gaussian mode has been obtained at electrical efficiencies approaching 4 percent. Author (GRA)

N77-25527# Naval Research Lab., Washington, D. C.
SSPARAMA: A NONLINEAR, WAVE OPTICS MULTIPULSE (AND CW) STEADY-STATE PROPAGATION CODE WITH ADAPTIVE COORDINATES Final Report
K. G. Whitney, G. L. Mader, and P. B. Ulrich 10 Feb. 1977 81 p refs
(AD-A037395; NRL-8074) Avail: NTIS HC A05/MF A01 CSCL 20/5

This report describes the numerical procedures that are used to calculate the steady-state atmospheric propagation and thermal blooming of either a train of high-energy laser pulses or a CW beam. The calculation is performed through the aid of a sequence of coordinate and variable transformations that enable one to adapt the scale and location of the transverse coordinate system to the amount of diffraction or thermal blooming taking place during beam propagation. A description is also given of the input parameters and diagnostics provided in the calculation along with a listing of the computer program. Author (GRA)

N77-25528# Air Force Academy, Colo. Frank J. Seiler Research Lab.
NEW GAS LASERS Final Report, 30 Sep. 1975 - 1 Aug. 1976
William E. McDermott, Richard E. Lotz, Myron L. DeLong, and David M. Thomas Aug. 1976 27 p refs
(AF Proj. 7903; AF Proj. 2303)
(AD-A036781; FJSRL-TR-76-0011) Avail: NTIS HC A03/MF A01 CSCL 20/5

This report concludes studies begun under FJSRL Work Unit 7903-03-69. Additional work in this area will be continued as FJSRL Task 2303-F4. The objective of this study is to develop a chemical method for producing O2(delta g) in the gas phase and evaluating the O2(delta g)-I transfer chemical laser. A heterogeneous flow reactor was designed in which 90% H2O2 was coated on a glass substrate and exposed to a gas flow of Cl2 or Cl2O. The oxygen generated in the gas phase from the alkaline hypochlorite-peroxide reaction was detected down stream of the reactor via Electron Paramagnetic Resonance Spectroscopy. A yield of 11% O2(delta) to total oxygen was observed for the Cl2/H2O2 system. This represents an intrinsic reaction efficiency of 16%. The lower total yield arises from the contribution of O2 produced by the decomposition of the peroxide solution. The highest total yield for the Cl2O/H2O2 system was 8.4%. The latter system produced O2(delta g) without the addition of base to the H2O2 (5% yield). Author (GRA)

N77-25529# Stanford Univ., Calif. W.W. Hansen Labs. of Physics.
FREE ELECTRON LASER Final Report, 15 Jul. - 8 Oct. 1976

J. M. Madey and H. A. Schwettman Dec. 1976 15 p
(Contract F49620-76-C-0018; AF Proj. 9768)
(AD-A036726; AFOSR-77-0090TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

Construction of the high current pulsed gun was completed, and the system was used with the superconducting accelerator to generate a high current 24 MeV electron beam. Experiments were conducted with the free electron laser oscillator at 10 microns. The pulsed gun consists of the electron gun and the electronics to drive the gun. The electronics were designed to the gun at a rate corresponding to the round trip optical transit time for the FEL resonator (11.8 MHz) while maintaining the pulse length below 1.5 nsec. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-25530 British Library Lending Div., Boston Spa (England).
EXPERIMENTAL INVESTIGATION ON CLEARANCE SEALS WITH RADIAL OUTWARD FLOW
W. Wagner May 1976 13 p refs Transl. into ENGLISH from VDI Report nr. 193, Brunswick, 1973
(BLL-M-24849-(5828.4F); VDI-193) Avail: British Library Lending Div., Boston Spa, Engl.

Resistances of clearance seals with radial outward flow were investigated. Characteristic quantities are experimentally determined as functions of geometrical quantities, and the Reynolds number is defined as a factor for clearance volume flow. B.B.

N77-25531 British Library Lending Div., Boston Spa (England).
THE EFFECT OF ELECTRIC ARC WELDING ATMOSPHERE ON WELDABILITY OF HIGH TENSILE STEELS
[1974] 64 p Transl. into ENGLISH from Commission of the European Communities EUR 5191, Dec. 1974
(BLL-CE-Trans-6977-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The effect of hydrogen on crack resistance when welding low alloy high strength steels with coated rods was studied. Individual electrodes of a batch showed variable behavior. Tests were made on two water quenched and tempered steels type St E 70, and one normalized steel, type St E 50. The electrodes had basic lime coatings. In addition tests were made on cross test pieces by subjecting a signal pass weld to a biaxial stress. The resulting pattern of curves was typical of static fatigue, and the strong effect of hydrogen was noticeable. Under the mentioned conditions the long term strength of welded joints may be raised if welding is accompanied by preheating. Author

N77-25532 British Library Lending Div., Boston Spa (England).
KINETIC MODEL OF ADHESION FRICTION
A. V. Krupin, V. N. Chernyshev, and L. M. Klinger [1976] 11 p refs Transl. into ENGLISH from Izv. VUZ Chernaya Met. (Moscow), no. 9, 1976 p 95-98 In ENGLISH and RUSSIAN (BLL-M-25512-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A model is suggested for adhesion friction which accounts for the formation and rupture kinetics of the adhesion bonds as well as of their deformation due to relative slip of the contact surfaces. A kinetic equation is obtained the solution of which presents the possibility of determining the total number of bonds, the friction force and a number of other parameters as functions of time, slip speed, and temperature. The static solution to this equation is examined. The relationship obtained expressing the friction force as a function of the slip speed appears as a curve with a maximum. The friction force is proportional at low slip speeds and inversely proportional at high slip speeds to the latter. The effect of temperature is discussed. Author

N77-25533 British Library Lending Div., Boston Spa (England).
THE CIRCULAR CYLINDER SHELL HAS A STRUCTURAL ELEMENT
Cosmas M. Lang Feb. 1977 39 p refs Transl. into Maschinenmarkt (W. Germany), v. 74, no. 97, 1968 p 1853-1862
(BLL-RTS-10439) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 EUK BLL coupons

The assembly, function, application field, frictional and leak-proof behaviour of a novel metal seal consisting of a circular cylinder shell, and the relationship between the properties of the shell, and it's behaviour as a seal are examined. The new seal is distinguished by low friction, tightness, and a practicable combination of the properties of steel or metal with high plastic deformation. It can be readily adapted to special requirements through a number of constructive forms and is eminently suitable for tightening hydraulic elements. The new component is also applicable as a control, setting and connecting element. Author

N77-25534*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
DEVELOPMENT OF A PLASMA SPRAYED CERAMIC GAS PATH SEAL FOR HIGH PRESSURE TURBINE APPLICATIONS Final Report, 2 Oct. 1975 - 31 Dec. 1976
L. T. Shiembob 24 May 1977 124 p refs
(Contract NAS3-19759)
(NASA-CR-135183; PWA-5521) Avail: NTIS HC A06/MF A01 CSCL 11A

The plasma sprayed graded layered yittria stabilized zirconia (ZrO_2)/metal(CoCrAlY) seal system for gas turbine blade tip applications up to 1589 K (2400 F) seal temperatures was studied. Abradability, erosion, and thermal fatigue characteristics of the graded layered system were evaluated by rig tests. Satisfactory abradability and erosion resistance was demonstrated. Encouraging thermal fatigue tolerance was shown. Initial properties for the plasma sprayed materials in the graded, layered seal system was obtained, and thermal stress analyses were performed. Sprayed residual stresses were determined. Thermal stability of the sprayed layer materials was evaluated at estimated maximum operating temperatures in each layer. Anisotropic behavior in the layer thickness direction was demonstrated by all layers. Residual stresses and thermal stability effects were not included in the analyses. Analytical results correlated reasonably well with results of the thermal fatigue tests. Analytical application of the seal system to a typical gas turbine engine application predicted performance similar to rig specimen thermal fatigue performance. A model for predicting crack propagation in the sprayed ZrO_2/CoCrAlY seal system was proposed, and recommendations for improving thermal fatigue resistance were made. Seal system layer thicknesses were analytically optimized to minimize thermal stresses in the abradability specimen during thermal fatigue testing. Rig tests on the optimized seal configuration demonstrated some improvement in thermal fatigue characteristics. Author

N77-25535*# National Aeronautics and Space Administration. Pasadena Office, Calif.
INTERNAL COMBUSTION ENGINE WITH ELECTROSTATIC DISCHARGING FUELS Patent Application
James B. Stephens (JPL) and Charles G. Miller, inventors (to NASA) (JPL) Filed 19 Apr. 1977 16 p
(Contract NAS7-100)
(NASA-Case-NPO-13798-1; US-Patent-Appl-SN-788856) Avail: NTIS HC A02/MF A01 CSCL 21A

An internal combustion engine system is discribed in which a mixture of air and fuel droplets which are electrostatically charged to a selective polarity is fed to the engine's chambers. The fuel droplets are of uniform size in the micron range, and tend to be uniformly distributed in each chamber. Each chamber includes an electrode which, at a particular point in the engine's cycle of operation, is electrically connected to a pontential of polarity opposite the polarity of the fuel droplets' charge to initiate electrostatic discharging of the droplets. The discharging produces sparks which initiate the combustion of the fuel droplets. Due to electrically insulating matter in the chambers' walls the charged droplets, prior to combustion, are repelled away from the walls to minimize combustion quenching. NASA

N77-25536*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NON-FLOATING UNIVERSAL JOINT Patent Application

Walter T. Appleberry, inventor (to NASA) (Rockwell Intern., Downey, Calif.) Filed 4 May 1977 8 p
(Contract NAS9-14000)
(NASA-Case-MSC-19546-1; US-Patent-Appl-SN-793670) Avail: NTIS HC A02/MF A01 CSCL 13I

A universal joint for connecting driving and driven torque shaft members is described. Axial and radial stability, and an allowance for limited axial angular misalignment between shaft members is achieved by means of ball and socket parts. These parts are located on the axis of the joint with male crown spline means which are spaced outward from the shaft axis engaging female straight splines. The ball and socket parts are centered in the crowned spline portion with the socket secured to the crowned spline and the ball portion secured to the female joint part. NASA

N77-25537*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELASTIC DISTORTION OF FLANGED INNER RING OF HIGH-SPEED CYLINDRICAL ROLLER BEARING
Christopher M. Taylor (Leeds Univ.) Washington Jun. 1977 18 p refs
(NASA-TN-D-8504; E-9054) Avail: NTIS HC A02/MF A01 CSCL 13I

The elastic distortion of the inner ring of an experimental roller bearing is investigated analytically. The geometry of the experimental bearing is unusually complex, and for this reason a bearing with an axially symmetric inner ring is also analyzed. Only the inner ring and shaft are considered using a two dimensional finite element program that can accommodate interference between these components. The results suggest that the elastic distortions are modest in relation to the design clearances associated with the experimental bearing. The variation of the radial deflection of the raceway may, however, be significant in some circumstances. Author

N77-25538# National Swedish Road and Traffic Research Inst., Linkoeping.
TIRE DIMENSIONS. PROPERTIES OF WIDE AND LOW VERSUS NARROW AND HIGH TIRES
Ulf Sandberg, Carl Formgren, and Evert Ohlsson 1976 23 p refs Sponsored by Swed. Board for Tech. Develop.
(VTI-108-A) Avail: NTIS HC A02/MF A01

In order to examine the characteristics of a tire of extremely small width and large overall diameter relative to recent tire constructions, a study of available literature dealing with dimensional influence on tire performance was made. Relevant experimental data was found to be rare, and thus definite conclusions regarding the dimensional influence were difficult to make. Results show that the premised tire constructions have advantages and disadvantages in largely different respects; perhaps the most important being decreased cornering stability but increased hydroplaning limits for a high and narrow relative to a low and wide tire. On a total basis, none of the studied dimensional alternatives seems to be remarkably better or worse than the other, and the ultimate choice of dimensions depends on how their respective qualities are valued. Author (ESA)

N77-25539# Societe Europeenne de Propulsion, Bordeaux (France).
STUDY, DEVELOPMENT AND QUALIFICATION OF AN ELECTROVALVE WITH DOUBLE FLEXIBLE SEAT. VOLUME 1: DEVELOPMENT OF AN ELECTROVALVE WITH DOUBLE FLEXIBLE SEAT Final Report [ETUDE, DEVELOPPEMENT ET QUALIFICATION D'UNE ELECTROVANNE A DOUBLE SIEGE SOUPLE. TOME 1. DEVELOPPEMENT D'UNE ELECTROVANNE A DOUBLE-SIEGE SOUPLE]
J. C. Rigal 30 Aug. 1976 70 p refs In FRENCH 2 Vol.
(Contract ESTEC-2066/73-HP)
(SEP-TS/SE-43.252/75-Vol-1; ESA-CR(P)-908-Vol-1) Avail: NTIS HC A04/MF A01

A study was carried out aimed at replacing rigid valve seats by flexible seats for an electrovalve used for hydrazine supply to a microrocket engine. A flexible material was selected as a function of its compatibility with hydrazine, and two geometric configurations were chosen for the seats. The flexible seat in PTFE was integrated in an existing electrovalve and tested. The work leading to the realization of a work packet for the valve qualification model is reported. ESA

N77-25540# Societe Europeenne de Propulsion, Bordeaux (France).
STUDY, DEVELOPMENT AND QUALIFICATION OF AN ELECTROVALVE WITH DOUBLE FLEXIBLE SEAT. VOLUME 2: QUALIFICATION AND SUPPLEMENTARY TESTS Final Report [ETUDE, DEVELOPPEMENT ET QUALIFICATION D'UNE ELECTROVANNE A DOUBLE SIEGE SOUPLE. TOME 2. ESSAIS DE QUALIFICATION ET COMPLEMENTAIRES]
J. C. Rigal 30 Aug. 1976 45 p refs In FRENCH
(Contract ESTEC-2066/73-HP)
(SEP-TS/SE-43.252/75-Vol-2; ESA-CR(P)-908-Vol-2) Avail: NTIS HC A03/MF A01

A study was carried out aimed at replacing rigid valve seats by flexible seats for an electrovalve used for hydrazine supply to a microrocket engine. A flexible material was selected as a function of its compatibility with hydrazine, and two geometric configurations were chosen for the seats. The flexible seat in PTFE was integrated in an existing electrovalve and tested. All the qualification tests on the two valve models, as well as supplementary tests on the first model, are reported. ESA

N77-25541# Fulmer Research Inst. Ltd., Stoke Poges (England).
DEVELOPMENT OF MEMORY METAL BOOM LATCH AND RELEASE MECHANISM Final Report
G. B. Brook, D. Powley (BAC, Bristol, Engl.), J. M. Cook (Univ. of Cambridge, Engl.), and W. H. Bowyer Feb. 1977 123 p refs
(Contract ESTEC-2527/75-PP(SC))
(ESA-CR(P)-921) Avail: NTIS HC A06/MF A01

The design of a boom latch and release mechanism triggered by a TiNi shape memory element is presented and discussed. The form of the shape memory element is considered and a torsional form was selected in which the element is heated by an internal heater. Design data are presented for TiNi alloys in tension, compression, and torsion. It is shown that the energy available and stress developed at maximum work capacity depend exponentially with shape memory strain. The selected latch and release mechanism comprised two ball-bolts released simultaneously by the trigger. The design and reasons for its selection are discussed. The construction, mode of operation, and testing of the mechanism are described, and the results of tests assessed in terms of the original specification. It is shown that the mechanism was capable of satisfying the specification with ample reserve, e.g., a smaller element would have provided sufficient energy to operate the mechanism. The relative advantages and disadvantages of shape memory elements are pointed out and a guide to designing with shape memory alloys provided. There is a lack of knowledge of some aspects of shape memory alloy behavior, examples of which are given. Author (ESA)

N77-25542# Bari Univ. (Italy). Ist. di Macchine.
THE OPERATION DURING OFF-DESIGN CONDITIONS OF SUPERCHARGED TWO-STROKE SPONTANEOUS COMBUSTION ENGINES [SUL FUNZIONAMENTO FUORI CONDIZIONI DI PROGETTO DI MOTORI AD ACCENSIONE SPONTANEA A DUE TEMPI SOVRALIMENTATI]
Andrea Dadone, Bernardo Fortunato, and Michele Napolitano Jul. 1976 29 p refs In ITALIAN; ENGLISH summary
(Contract CNR-75.01135.07)
Avail: NTIS HC A03/MF A01

A theoretical model is outlined which is suitable for predicting the off-design performances of marine exhaust gas turbo-charged two-stroke Diesel engines. Theoretical performances obtained by means of an electronic computer, were compared with experimental results. Good agreement was found between theoretical predictions and experimental results. Author (ESA)

N77-25543# Bari Univ. (Italy). Ist. di Macchine.
VOLUMETRIC EFFICIENCY OF ROOTS BLOWERS
Andrea Dadone and Gaetano Vacca Pavia Assoc. Termotec. Ital. 17 Sep. 1976 22 p refs In ITALIAN; ENGLISH summary
Presented at the 31st Congr. Nazl. Assoc. Termotec. Ital., Pavia, Italy, 13-17 Sep. 1976
(Contract CNR-75.01135.07)

Avail: NTIS HC A02/MF A01

A Roots blower was tested and its volumetric efficiency compared with values obtained by means of three theoretical models. Such theoretical values were also compared with experimental ones reported in the literature. Volumetric efficiency obtained by two theoretical models are in a good agreement with experimentally obtained values. Author (ESA)

N77-25544# Bari Univ. (Italy). Ist. di Costruzione di Macchine.

EFFECT OF INERTIA MOMENT ON CRITICAL SPEED CALCULATION OF ROTATING SHAFTS [EFFETTO DEL MOMENTO RADDRIZZANTE SUL CALCOLO DELLE VELOCITA CRITICHE DI ALBERI ROTANTI]

Bruno Atzori 16 Oct. 1976 12 p refs In ITALIAN; ENGLISH summary Presented at the 3d Congr. Nazl. dell'Ass. Ital. di Meccan. Teorica e Appl., Cagliari, Italy, 13-16 Oct. 1976

Avail: NTIS HC A02/MF A01

The effect of taking into account the lateral inertia in the computation of critical speeds of rotating shafts was analyzed. The power method, Von Borowicz's method, Dunkerley's method, and the matrix displacement and force methods were considered. Some procedure for extending the validity of the examined method is described after analyzing the mathematical implications due to the presence of negative eigenvalues. Author (ESA)

N77-25545# Alabama Univ., Huntsville. School of Graduate Studies and Research.

VALIDATION OF GENERALIZED CUSHIONING MODELS FOR SELECTED TEMPERATURE SENSITIVE CUSHIONING MATERIALS, VOLUME 1 Final Report, 24 Oct. 1975 - 23 Oct. 1976

Richard M. Wyskida and James D. Johannes Oct. 1976 131 p refs

(Contract DAAH01-76-C-0205)

(AD-A032556; UAH-RR-187-Vol-1; RL-CR-76-7-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 13/4

This research report utilizes the results of previous MICOM container cushioning research efforts in the development of a validation procedure for the various cushioning material models being developed. The cushioning materials considered are: (1) Minicel - 2 lbs/cu ft, (2) Ethafoam - 2 lbs/cu ft, (3) Ethafoam - 4 lbs/cu ft, (4) Polyester Urethane - 4 lbs/cu ft, and (5) Polyether Urethane - 3 lbs/cu ft. GRA

N77-25546# Alabama Univ., Huntsville. School of Graduate Studies and Research.

CONTAINER CUSHIONING DESIGN ENGINEER USERS MANUAL (HP-9810A VERSION), VOLUME 2 Final Report, 24 Oct. 1975 - 23 Oct. 1976

Richard M. Wyskida, James D. Johannes, and Mickey R. Wilhelm Oct. 1976 147 p refs

(Contract DAAH01-76-C-0205)

(AD-A032557; UAH-RR-187-Vol-2; RL-CR-76-7-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 13/4

A cushioning system is an interface device which isolates a protected item from the shock loads which develop in its external environment. Such a system is required when the protected item cannot survive the shock loads imposed by the external environment, unless these loads are attenuated by some form of cushioning system. The design of a cushioning system; therefore, involves stipulations concerning both the item to be protected and the external environment. These two stipulations of how much shock an item can survive, and how much shock it is expected to experience in its environment are questions that must be answered in the design of any cushioning system. GRA

N77-25547# Ultrasystems, Inc., Irvine, Calif.

STUDY ON OXIDES OF NITROGEN AND CARBON FORMATION IN DIESEL ENGINES Final Report, Jun. 1973 - Jun. 1976

C. J. Kau, T. J. Tyson, and M. P. Heap Mar. 1976 199 p refs 2 Vol.

(Contract EPA-68-01-0436)

(PB-262712/3; EPA-460/3-76-008a) Avail: NTIS HC A09/MF A01 CSCL 13B

A mathematical model describing heat release and pollutant formation in direct injection diesel engines was developed and tested. Sensitivity studies indicate that the model is most responsive to those constants which control fuel/air mixing. Numerical experiments suggest that diffusion flames modelled by spherical droplet flames are unsuitable for this type of system. The model was tested against results obtained with a single cylinder diesel engine. Reasonable predictions of the influence of engine design and operation parameters on NOx emissions were obtained. GRA

N77-25548# Ultrasystems, Inc., Irvine, Calif.

STUDY ON OXIDES OF NITROGEN AND CARBON FORMATION IN DIESEL ENGINE: COMPUTER PROGRAM USER'S MANUAL Final Report, Jun. 1973 - Jun. 1976

C. J. Kau and T. J. Tyson Mar. 1976 101 p 2 Vol.

(Contract EPA-68-01-0436)

(PB-262713/1; EPA-460/3-76-008b) Avail: NTIS HC A06/MF A01 CSCL 13B

The computer program is described and a user's manual is presented for a numerical model on the prediction of pollutant formation in diesel engines. The model is capable of predicting both engine performance and formation of nitric oxide and soot in a direct injected diesel engine combustion process. The program is sufficiently versatile to investigate the influence of several engine parameters, such as geometry, injection timing, compression ratio, load, swirl, etc., and thus is considered as a tool readily accessible to the design engineers. The physical and chemical processes, the detailed mathematical analysis and the assumptions upon which the model is based are discussed. GRA

N77-25549# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

BALLISTIC IMPACT BETWEEN A BLUNT ELASTIC PROJECTILE AND AN ELASTIC-PLASTIC PLATE M.S. Thesis

Kenneth C. Leone Dec. 1976 78 p refs

(AD-A034939; GAE/MC/76D-4) Avail: NTIS HC A05/MF A01 CSCL 19/4

A cylindrical rod on rod impact model is developed that allows for linear elastic strains in the projectile and linear elastic-plastic strains in the target plug. Application is made to the plate impact problem. Normal incidence impact of two circular cylinders is considered. One-dimensional stress waves load the projectile and the plug in compression and tension. Stress wave interactions are tracked in the projectile and in the plug. Momentum balance is used to solve for resultant stresses and particle velocities. Optimum conditions are determined for the initial impact that allow the plug to be accelerated uniformly to the initial projectile velocity. Optimum plug length/projectile length ratio is found to decrease with increasing projectile initial velocity. Separation of the projectile and plug is predicted and separation times are determined. GRA

N77-25550# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.

A MODEL FOR FUEL-AIR MIXING IN THE TEXACO CONTROLLED COMBUSTION STRATIFIED CHARGE ENGINE

Bhag C. Jain, James C. Keck, and Joe M. Rife Jan. 1976 49 p refs

(Contracts DAAE07-73-C-0282; DAAE07-74-C-0268)

(AD-A032914; FML-76-1) Avail: NTIS HC A03/MF A01 CSCL 21/4

A jet model with standard turbulent entrainment assumptions has been developed to predict the spray formation processes in engines. The model has specifically been applied to controlled combustion system, stratified charge engine. While the analysis has been carried out as part of a general effort to develop a model to predict the performance of the engine, the potential use of the jet model, by itself, as a design tool has also been demonstrated through a parametric study. Some characteristic lengths useful in evaluating different fuels have also been described. The purpose has been to show that the performance model developed for the engine can be used for a large number of fuels of practical interest. GRA

N77-25551# Battelle Columbus Labs., Ohio.

EVALUATION OF METHODS FOR MEASURING AND CONTROLLING HYDROCARBON EMISSIONS FROM

PETROLEUM STORAGE TANKS Final Report
D. A. Ball, A. A. Putnam, and R. G. Luce Nov. 1976 100 p refs
(Contract EPA-68-01-3159)
(PB-262789/1; EPA-450/3-76-036) Avail: NTIS HC A05/MF A01 CSCL 13B

The API (American Petroleum Institute) emissions test procedures were found to be technically sound although they require extensive test times to obtain significant results. Little change was seen to increase accuracy or reduce the test time of these procedures. Several new test procedures were analyzed and one was felt to have promise of achieving accurate emissions results in substantially reduced test times. GRA

N77-25552# Systems Science and Software, La Jolla, Calif.
THE RESPONSE OF THIN TARGETS TO PROJECTILE IMPACT Final Report
J. K. Dienes Dec. 1976 55 p refs
(Contract DAAD05-75-C-0724)
(AD-A035171; SSS-R-75-2630; BRL-CR-323) Avail: NTIS HC A04/MF A01 CSCL 19/1

The response of thin targets to projectile impact is investigated under the assumption that membrane theory is sufficient to describe the interaction theoretically derived. Residual velocities of penetrating projectiles for a number of materials are compared with experimental data. The method allows data for a specific target thickness, projectile size and projectile velocity to be used in determining the ballistic properties under other impact conditions. This requires that a value for the ballistic figure of merit, W, be obtained for each material, which can then be used to rank a number of materials in a quantitative fashion, although the tests performed were quite dissimilar.Author (GRA)

N77-25553# Michigan State Univ., East Lansing. Div. of Engineering Research.
MEASUREMENT OF RESIDUAL STRAINS AROUND COLDWORKED FASTENER HOLES Interim Report, Mar. 1975 - Mar. 1976
William N. Sharpe, Jr. Apr. 1976 89 p refs
(Grant AF-AFOSR-2817-75; AF Proj. 6813; AF Proj. 9782)
(AD-A035147; AFOSR-77-0020TR) Avail: NTIS HC A05/MF A01 CSCL 20/11

Coldworking a fastener hole by pulling an oversize mandrel through it can improve its fatigue life because of the residual stresses generated around the hole. This report describes an experimental study of the residual strains around the hole and compares the results with existing theories. An industrial coldworking process is studied, and strains are determined close to the hole by measuring the distance between fiducial marks with an X-Y microscope and by the moire method. The strains near the hole are large (on the order of 5-10 percent) and inhomogeneous. None of the theories predict the strains well, though better agreement is obtained for thinner test specimens at positions away from the hole edge. GRA

N77-25554# New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
ELASTOHYDRODYNAMIC LUBRICATION WITH WEAR AND ASPERITY CONTACT IN MECHANICAL FACE SEALS Annual Report, 1 Dec. 1975 - 30 Nov. 1976
A. O. Lebeck, J. L. Teale, and R. E. Pierce Jan. 1977 157 p refs
(Contract N00014-76-C-0071)
(AD-A035410; ME-76(77)ONR-414-1) Avail: NTIS HC A08/MF A01 CSCL 11/1

In this report lubrication effects caused by waviness in contacting mechanical face seals are investigated. A lubrication model is developed which includes the effects of hydrodynamic lubrication in conjunction with asperity contact, asperity contact pressure, elastic deformation of the seal rings, and wear of the surfaces. Several sources of initial waviness are considered. Based on a one dimensional model, it is shown that some amount of hydrodynamic load support can be expected to occur in a water seal even though there is a considerable fraction of rubbing contact. As the fraction of load supported by hydrodynamic pressure becomes greater, the average wear rate will become smaller. Thus any parameter changes which cause greater hydrodynamic support are desirable. It is shown that there exists an optimum initial waviness and face width to maximize hydrodynamic load support. It is also shown that lower values of surface roughness lead to higher load support. Time dependent effects are obtained by including wear in the model. It is shown that most initial waviness will wear away under steady state operating conditions, and thus hydrodynamic load support will decrease with time. Neither thermal effects nor friction effects alter this behavior. However, a variable sealed pressure may lead to a stable or increasing fraction of hydrodynamic load support. GRA

N77-25555# Naval Postgraduate School, Monterey, Calif.
ANALYTICAL AND EXPERIMENTAL DETERMINATION OF CHARACTERISTICS OF A TRANSONIC AXIAL TURBINE M.S. Thesis
Billy Carrol Boatright Dec. 1976 122 p refs
(AD-A035876) Avail: NTIS HC A06/MF A01 CSCL 21/5

An analysis and test rig measurements of the performance of a transonic axial turbine are reported. The purpose was to confirm the accuracy of measurements made in a test rig which was designed to separate the losses occurring in the stator from the losses occuring in the rotor blade rows. Reasonable agreement between predicted and measured characteristics was obtained using experimentally determined losses in the computer program. Lack of agreement was noted using theoretical values. It was concluded that the rotor was not choked at the conditions in the tests, and that the test rig measurements were valid. A successful technique for smoothing the data obtained from the rig is also reported. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-25556*# Boeing Aerospace Co., Seattle, Wash. Electronic Parts and Subsystems.
EVALUATION TESTING OF SOLID ENCAPSULATED MICROCIRCUITS FOR SPACE APPLICATIONS Final Technical Report, Jun. 1975 - May 1977
Donald D. Robinson May 1977 179 p refs
(Contract NAS8-31627)
(NASA-CR-150273; D18C-20546-1) Avail: NTIS HC A09/MF A01 CSCL 14D

Epoxy encapsulated microcircuits were subjected to various thermal, vibration, thermal cycling, and reduced barometric pressure stress tests to obtain electrical, environmental, and failure data. Analyses of the data were employed to derive information on environmental and operating design limits to determine the capability of encapsulated microcircuits to perform in space applications and environments. Seven different part types (four TTL, two CMOS, one linear) from five different manufacturers were subjected to single, multiple, and combinational environmen tal stress levels to determine: (1) what failure mechanisms are unique to encapsulated microcircuits; (2) how believable are suppliers claims of improved reliability, (3) what stress tests and screens can be used to identify potential early failure, and (4) what stress tests and screens should be avoided to prevent unwanted life degradation. Author

N77-25557*# Massachusetts Inst. of Tech., Cambridge.
CONSTITUTIVE ACOUSTIC-EMISSION ELASTIC-STRESS BEHAVIOR OF MAGNESIUM ALLOY Final Report
James H. Williams, Jr. and George P. Emerson Washington NASA Jun. 1977 42 p refs
(Grant NsG-3064)
(NASA-CR-2839) Avail: NTIS HC A03/MF A01 CSCL 14D

Repeated laoding and unloading of a magnesium alloy below the macroscopic yield stress result in continuous acoustic emissions which are generally repeatable for a given specimen and which are reproducible between different specimens having the same load history. An acoustic emission Bauschinger strain model is proposed to describe the unloading emission behavior. For the limited range of stress examined, loading and unloading

stress delays of the order of 50 MN/sq m are observed, and they appear to be dependent upon the direction of loading, the stress rate, and the stress history. The stress delay is hypothesized to be the manifestation of an effective friction stress. The existence of acoustic emission elastic stress constitutive relations is concluded, which provides support for a previously proposed concept for the monitoring of elastic stresses by acoustic emission. Author

N77-25558# Argonne National Lab., Ill.
EVALUATION OF ULTRASONIC TECHNIQUES FOR DETECTION OF STRESS-CORROSION CRACKS IN STAINLESS STEEL PIPING
D. S. Kupperman, C. L. Johnson, and W. A. Ellingson 1976 11 p refs Presented at Am. Soc. for Nondestructive Testing Flash X-ray Symp., Houston, Tex., 27 Sep. 1976
(Contract W-31-109-eng-38)
(CONF-760914-9) Avail: NTIS HC A02/MF A01

Ultrasonic pulse-echo methods are evaluated for their adequacy in the detection of intergranular stress-corrosion cracking in Type 304 stainless steel nuclear reactor piping. The effectiveness of ultrasonic examinations of 100-mm and 250-mm Schedule 80 Type 304 stainless steel pipes is discussed. Both welded and unwelded pipes were investigated with commercially available ultrasonic systems. Focused and dual-angle-beam probes specially designed for the inspected pipes were also evaluated. ERA

N77-25559# Los Alamos Scientific Lab., N. Mex.
IMAGE PROCESSING IN NONDESTRUCTIVE TESTING
D. H. Janney 1976 21 p refs Presented at 23d Sagamore Army Materials Res. Conf., Raquette Lake, N. Y., 24 Aug. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1867; Conf-760859-2) Avail: NTIS HC A02/MF A01

The advantages of optical methods were low cost and very high speed, but are often inflexible and are sometimes very difficult to implement due to practical problems. Computerized methods are very flexible, they can use very powereful mathematical techniques, but usually are difficult to implement for very high throughput. Recent technological developments in microprocessors and in electronic analog image analyzers are studied as the key to resolving the shortcomings of the two classical methods of image analysis. ERA

N77-25560# California Univ., Livermore. Lawrence Livermore Lab.
STATISTICAL APPROACH FOR ESTIMATING THE RELIABILITY OF HIGHLY STRESSED XENON FLASHLAMPS
N. G. Smiriga Feb. 1976 22 p refs Presented at 2d ERDA Statistical Symp., Oak Ridge, Tenn., 25 Oct. 1976
(Contract W-7405-eng-48)
(UCRL-78742; Conf-761023-1) Avail: NTIS HC A02/MF A01

Shiva consists of 2,200 flashlamp units. The reliability of such units is studied. The probability that none of the units will fail if they are to undergo a certain number of shots (say 50, 100 or 200) provided that all these units were tested for a given number of shots is estimated. The data used to develop the methods are given. Suitable models for the failure rate of an individual unit are considered, and the parameters for these models are computed. The best model is selected, and reliability estimates are made using the limited data available. The steps that were taken to evaluate this estimate are summarized. ERA

N77-25561# California Univ., Livermore. Lawrence Livermore Lab.
FLASH X-RAY
Quintin Johnson and D. Pellinen 7 Sep. 1976 62 p refs Presented at 23d Sagamore Army Mater. Res. Conf., Raquette Lake, N. Y., 24 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-78466) Avail: NTIS HC A04/MF A01

The complementary techniques of flash X-ray radiography (FXR) and flash X-ray diffraction (FXD) were studied to explore their use in nondestructive materials testing. FXR is useful in studies of macroscopic properties during extremely short time intervals, and FXD, the newer technique, is used in studies of microscopic properties. Although these techniques are similar in many respects, there are some substantial differences. FXD generally requires low-voltage, line-radiation sources, and extremely accurate timing; FXR is usually less demanding. Phenomena which can be profitably studied by FXR often can also be studied by FXD to permit a complete materials characterization. ERA

N77-25562# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
RELIABILITY ACCEPTANCE SAMPLING PLANS BASED UPON PRIOR DISTRIBUTION. VOLUME 1: INTRODUCTION AND PROBLEM DEFINITION Final Technical Report, Jun. 1975 - Aug. 1976
Amrit L. Goel and Anand M. Joglekar Griffiss AFB, N. Y. RADC Sep. 1976 25 p refs 5 Vol.
(Contract F30602-71-C-0312)
(AD-A033515; TR-76-1-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 12/2

The problem of the design and analysis of reliability acceptance sampling plans in the presence of heterogeneous production is discussed in this report. A summary of the work done on various aspects of this problem is also presented. Author (GRA)

N77-25563# Stanford Univ., Calif. Dept. of Statistics.
FAILURE DISTRIBUTIONS OF SHOCK MODELS
Gary Gottlieb 18 Oct. 1976 34 p refs
(Contract N00014-75-C-0561)
(AD-A033430; SU-TR-181) Avail: NTIS HC A03/MF A01 CSCL 20/11

This paper, considers a single device shock model. The device experiences shocks from the environment, each of which can render the device inoperable. Conditions of the shock process and of the ability of the device to survive shocks are found so that the time to failure distribution of the device falls into one of the common reliability theory classifications. These results are extended to the case where the shock process can be viewed as continuous. GRA

N77-25564# California Univ., Los Angeles. School of Engineering and Applied Science.
A COMPUTER-ORIENTED APPROACH TO FAULT-TREE CONSTRUCTION
S. L. Salem, G. E. Apostolakis, and D. Okrent Apr. 1976 287 p refs Sponsored in part by Elec. Power Res. Inst.
(Grants NSF GI-39416; NSF OEP-75-20318)
(PB-261842/9; UCLA-ENG-7635; NSF/RA-760320) Avail: NTIS HC A13/MF A01 CSCL 14D

The systematic application of mathematical techniques to the problem of improving both qualitative and quantitative methods of analyzing the safety of large systems is presented. GRA

N77-25565# Weston (Roy F.), Inc., West Chester, Pa.
DEVELOPMENT OF SUSPENDED SOLIDS QUALITY CONTROL AND PERFORMANCE EVALUATION SAMPLES Final Report, 30 Jun. 1975 - 20 May 1976
Enos L. Stover and Peter J. Marks Oct. 1976 52 p refs
(Contract EPA-68-03-2333)
(PB-262250/4; EPA-600/4-76-052) Avail: NTIS HC A04/MF A01 CSCL 14D

A two phase study was conducted to develop a synthetic suspended solids sample for use as quality control check and performance evaluation within environmental monitoring laboratories. The first phase consisted of a feasibility study to determine compounds that exhibited the optimum physical and chemical properties for synthetic suspended solids samples, and the second phase involved production of suspended solids samples in individual containers. Compounds investigated that met all the design criteria included rayon fibers and Fuller's earth. GRA

N77-25566# National Bureau of Standards, Washington, D. C. Sensory Environment Section.
CONSIDERATIONS AND STANDARDS FOR VISUAL INSPECTION TECHNIQUES
Gary T. Yonemura Oct. 1976 21 p refs Presented at Symp. on Nondestructive Testing Standards; sponsored by NBS, ASTM and ASNT Submitted for publication
(PB-263099/4; NBSIR-76-1142) Avail: NTIS

HC A02/MF A01 CSCL 14B

Physical correlates of the response should be quantified, followed by a systematic scaling of the physical correlates for application to nondestructive testing. The Modulation Transfer Function widely used in optical imaging assessments would be an evaluation technique applicable to hardware, processing and image description. GRA

N77-25567# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

LOCAL METHODS FOR LOCALIZING FAULTS IN ELECTRONIC CIRCUITS

Johan DeKleer Nov. 1976 32 p refs

(Contracts N00014-75-C-0643; MDA903-76-C-0108)

(AD-A036007; AI-M-394) Avail: NTIS HC A03/MF A01 CSCL 09/3

The work described in this paper is part of an investigation of the issues involved in making expert problem solving programs for engineering design and for maintenance of engineered systems. In particular, the paper focuses on the troubleshooting of electronic circuits. Only the individual properties of the components are used, and not the collective properties of groups of components. The concept of propagation is introduced which uses the voltage-current properties of components to determine additional information from given measurements. Two propagated values can be discovered for the same point. This is called a coincidence. In a faulted circuit, the assumptions made about components in the coinciding propagations can then be used to determine information about the faultiness of these components. In order for the program to deal with actual circuits, it handles errors in measurement readings and tolerances in component parameters. This is done by propagating ranges of numbers instead of single numbers. Unfortunately, the comparing of ranges introduces many complexities into the theory of coincidences. In conclusions, we show how such local deductions can be used as the basis for qualitative reasoning and troubleshooting. Author (GRA)

N77-25568# Naval Weapons Engineering Support Activity, Washington, D. C.

MECHANICAL RELIABILITY DESIGN EVALUATION GUIDE STATUS REPORT Research Report, Jul. - Dec. 1976

F. M. Hall, C. Ellis, and W. Skewis 1 Dec. 1976 57 p refs

(AD-A035312; NAVWESA-37-76) Avail: NTIS HC A04/MF A01 CSCL 11/6

This interim report reviews the progress at the Naval Weapons Engineering Support Activity in development of a mechanical reliability design guide. Design evaluation techniques under consideration are included, with emphasis on the preparation of a Failure Mode and Effects Analysis (FMEA) Military Standard. Existing FMEA procedures are examined, and a FMEA standard procedure is recommended as a basis for developing improved reliability design evaluation techniques. Author (GRA)

N77-25569# Louisiana Tech Univ., Ruston. Div. of Engineering Research.

APPLICATION OF DIMENSIONAL ANALYSIS TO THE PREDICTION OF MECHANICAL RELIABILITY Research Report, Jul. - Sep. 1976

Jack Canterbury and James D. Lowther 20 Sep. 1976 42 p refs

(Contract N68335-76-C-2288)

(AD-A035295; LTU-2288-2) Avail: NTIS HC A03/MF A01 CSCL 14/4

This report documents a study to determine the feasibility of applying dimensional analysis to the prediction of mechanical reliability. The study concludes that dimensional analysis is an essential tool for the development of empirical models for mechanical reliability. As an example, dimensional analysis is applied to the prediction of mean-time-to-failure for involute splines. Advantages of dimensional analysis are enumerated. Author (GRA)

N77-25570# Louisiana Tech Univ., Ruston. Dept. of Mechanical Engineering.

COMPARATIVE ANALYSIS OF MECHANICAL RELIABILITY DETERMINATION TECHNIQUES Research Report, Nov. 1974 - Jun. 1976

Jack Canterbury and James D. Lowther 30 Jun. 1976 50 p refs

(Contract N68335-76-C-2253)

(AD-A035347; LTU-2253-1) Avail: NTIS HC A03/MF A01 CSCL 13/8

This report identifies, evaluates and compares the techniques presently available for mechanical reliability prediction. Techniques are classified in the following categories: design procedures incorporating reliability, techniques for predicting reliability, techniques for obtaining reliability data, and techniques for data analysis. A general approach for developing mechanical reliability prediction capability is outlined and research needed to further develop the prediction capability is specified. Author (GRA)

N77-25571# Hughes Aircraft Co., Culver City, Calif.

OPERATIONAL INFLUENCES ON RELIABILITY Final Technical Report, Apr. 1974 - Sep. 1976

G. A. Kern and T. M. Drnas Griffiss AFB, N. Y. RADC Dec. 1976 214 p refs

(Contract F30602-74-C-0221)

(AD-A035016; HAC-P76-212; RADC-TR-76-366) Avail: NTIS HC A10/MF A01 CSCL 14/4

This report presents the results of a study of the operational influences on the field reliability of USAF avionics equipment. The study has permitted identification of factors contributing to reported differences, between the required, predicted, demonstrated, and field observed reliability of avionics equipment in currently operational USAF aircraft systems. Techniques have also been developed by which the field reliability can be estimated using engineering data pertaining to the equipment's inherent reliability characteristics and field operational factors. Author (GRA)

N77-25060# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

A SURVEY OF DESIGN METHODS FOR FAILURE DETECTION IN DYNAMIC SYSTEMS

Alan S. Willsky *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 14 p refs (For primary document see N77-25055 16-01)

Avail: NTIS HC A16/MF A01

N77-25062# Polytechnic Inst. of New York, Brooklyn. Div. of Computer Science.

SOFTWARE RELIABILITY: ANALYSIS AND PREDICTION

Martin L. Shooman *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 17 p refs (For primary document see N77-25055 16-01)

(Contract N00014-67-A-0438-0013)

Avail: NTIS HC A16/MF A01

N77-25063# Marconi-Elliott Avionic Systems Ltd., Rochester (England). Flight Controls Div.

SOFTWARE INTEGRITY THROUGH VISIBILITY

G. Belcher and T. Egan *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 6 p refs (For primary document see N77-25055 16-01)

Avail: NTIS HC A16/MF A01

N77-25065# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

SYSTEM INTEGRITY BY USE OF SELFDIAGNOSING FAILURE DETECTION

R. Onken *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 18 p (For primary document see N77-25055 16-01)

Avail: NTIS HC A16/MF A01

N77-25070# Northrop Corp., Norwood, Mass. Dept. of Precision Products.

THRESHOLDLESS REDUNDANCY MANAGEMENT WITH ARRAYS OF SKEWED INSTRUMENTS

J. E. Potter and M. C. Suman *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 25 p refs (For primary document see N77-25055 16-01)

Avail: NTIS HC A16/MF A01

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-25572 British Library Lending Div., Boston Spa (England).
CALCULATING STRESS CONCENTRATION NEAR SUPPORTS FOR CYLINDRICAL AND SPHERICAL VESSELS
V. Krupka and J. Lancos [1974] 14 p refs Transl. into ENGLISH from a collection of papers presented at the seminar Stress Concentration and Numerical Calculation Methods, Zilina, Czechoslovakia, 12-13 Jun. 1974 p 111-126
(BLL-CE-Trans-6885-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Peak stresses at the support point in the case of dynamic loads are examined. The size and shape of local stress about the contact are determined. Both a cylindrical and spherical shell are considered. J.M.S.

N77-25573 British Library Lending Div., Boston Spa (England).
THE DESIGN OF INTERNALLY STRESSED COMPONENTS SUITABLE FOR STRAIN APPLICATIONS AND WELDING
J. Henjes 20 Dec. 1976 18 p refs Transl. into ENGLISH from Schweissen und Schneiden (Duesseldorf), v. 25, no. 4, 1973 p 124-129
(BLL-CE-Trans-6865-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Structural components under dynamic stress due to pulsating or alternating internal pressure were subject to considerable deformation particularly at the penetration points for branches and connecting pieces and at transitions with different wall thicknesses and elasticity rations. Stress relieved weld seams were generally less susceptible to damage than those relieved mechanically during the pressure test. Dynamically stressed welded joints were checked before and after the pressure test by a surface crack test method. Author

N77-25574# Polish Academy of Sciences, Warsaw.
SOLVING EDGE PROBLEMS IN RECTANGULAR PLATES BY THE POWER SERIES METHOD [ROZWIAZANIE ZAGADNIEN BRZEGOWYCH W TARCZACH PROSTOKATNYCH METODA SZEREGOW POTEGOWYCH]
Stefan Owczarek 1976 99 p refs In POLISH
Avail: Issuing Activity

A closed solution for defining the state of stress and deformation of a plane elastic medium with arbitrary loading applied to its edges is presented. The solution makes it possible to discuss technical theories for defining two dimensional states of stress in construction elements such as beams and walls. The method of power series expansion of all functions is used. Polynomial solutions of rectangular plane mediums deformed within the range of elasticity are included. Author

N77-25575*# General Electric Co., Philadelphia, Pa.
STIFFNESS COUPLING APPLICATION TO MODAL SYNTHESIS PROGRAM, USERS GUIDE
E. J. Kuhar 1976 26 p
(Contract NAS1-145197)
(NASA-CR-145197) Avail: NTIS HC A03/MF A01 CSCL 20K

A FORTRAN IV computer program used to perform modal synthesis of structures by stiffness coupling, using the dynamic transformation method is described. The program was named SCAMP (Stiffness Coupling Approach Modal-Synthesis Program). The program begins with the entry of a substructure's physical mode shapes and eigenvalues or a substructure's mass and stiffness matrix. If the mass and stiffness matrices are entered, the eigen problem for the individual substructure is solved. Provisions are included for a maximum of 20 substructures which are coupled by stiffness matrix springs. Each substructure has a number degrees of freedom (DOF), except that for DOF greater than 100; vector sets having maximum row and column size of 100 were generated prior to entering SCAMP. The substructures are then coupled together via coupling springs, and the dynamic transformation is used to reduce the size of the eigen problem. Author

N77-25576*# Martin Marietta Corp., Denver, Colo.
CHARACTERIZATION OF CRACK GROWTH UNDER COMBINED LOADING Final Report, 6 Jun. 1974 - 15 Mar. 1977
A. Feldman, F. W. Smith, and A. Holston, Jr. Jun. 1977 246 p refs
(Contract NAS3-17810)
(NASA-CR-135197; MCR-77-131) Avail: NTIS HC A11/MF A01 CSCL 13M

Room-temperature static and cyclic tests were made on 21 aluminum plates in the shape of a 91.4x91.4-cm Maltese cross with 45 deg flaws to develop crack growth and fracture toughness data under mixed-mode conditions. During cyclic testing, it was impossible to maintain a high proportion of shear-mode deformation on the crack tips. Cracks either branched or turned. Under static loading, cracks remained straight if shear stress intensity exceeded normal stress intensity. Mixed-mode crack growth rate data compared reasonably well with published single-mode data, and measured crack displacements agreed with the straight and branched crack analyses. Values of critical strain energy release rate at fracture for pure shear were approximately 50% higher than for pure normal opening, and there was a large reduction in normal stress intensity at fracture in the presence of high shear stress intensity. Net section stresses were well into the inelastic range when fracture occurred under high shear on the cracks. Author

N77-25577*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THREE DIMENSIONAL FINITE-ELEMENT ANALYSIS OF FINITE-THICKNESS FRACTURE SPECIMENS
I. S. Raju and J. C. Newman, Jr. Washington May 1977 42 p refs
(NASA-TN-D-8414; L-10967) Avail: NTIS HC A03/MF A01 CSCL 20K

The stress-intensity factors for most of the commonly used fracture specimens (center-crack tension, single and double edge-crack tension, and compact), those that have a through-the-thickness crack, were calculated using a three dimensional finite-element elastic stress analysis. Three-dimensional singularity elements were used around the crack front. The stress intensity factors along the crack front were evaluated by using a force method, developed herein, that requires no prior assumption of either plane stress or plane strain. The calculated stress-intensity factors from the present analysis were compared with those from the literature whenever possible and were generally found to be in good agreement. The stress-intensity factors at the midplane for all specimens analyzed were within 3 percent of the two dimensional plane strain values. The stress intensity factors at the specimen surfaces were considerably lower than at the midplanes. For the center-crack tension specimens with large thickness to crack-length ratios, the stress-intensity factor reached a maximum near the surface of the specimen. In all other specimens considered the maximum stress intensity occurred at the midplane. Author

N77-25578*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AEROTHERMAL AND STRUCTURAL PERFORMANCE OF A COBALT-BASE SUPERALLOY THERMAL PROTECTION SYSTEM AT MACH 6.6
James Wayne Sawyer Washington May 1977 54 p refs
(NASA-TN-D-8415; L-11286) Avail: NTIS HC A04/MF A01 CSCL 20D

A flightweight, metallic thermal protection system (TPS) applicable to reentry and hypersonic vehicles was subjected to multiple cycles of both radiant and aerothermal heating in order to evaluate its aerothermal performance and structural integrity. Good structural integrity and thermal performance were demonstrated by the TPS under both a radiant and aerothermal heating environment typical of a shuttle entry. The shingle-slip joints effectively allowed for thermal expansion of the panel without allowing any appreciable hot gas flow into the TPS cavity. The TPS also demonstrated good structural ruggedness. Author

N77-25579# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE DETERMINATION OF RESIDUAL STRESSES OCCURRING DURING COOLING OF VISCOELASTIC BODIES
S. E. Umanskii [1976] 5 p refs Transl. into ENGLISH from Dopov. Akad. Nauk USSR, Ser. A., Fiz. Mat. i Tekhn. Nauki (USSR), no. 12, 1976 p 1108-1113
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Fields of residual stresses, which have a significant influence on the strength, were found to occur as a result of the hardening and annealing of articles fabricated from amorphous materials. The determination of the residual stresses in such articles reduces to the solution of a thermo-rheological boundary value problem. A broad class of amorphous materials and a number of polymers were considered as linearly viscoelastic and thermo-rheologically simple. Author

N77-25580# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
THE PROPAGATION OF ELASTIC WAVES FROM MOVING NORMAL POINT LOADS IN LAYERED MEDIA
Abraham Ungar Jun. 1976 33 p refs
(CSIR-SR-WISK-211) Avail: NTIS HC A03/MF A01

The steady-state response is determined of elastic layered media to buried moving normal point loads. The exact solution is a superposition of infinitely many rays, each of them given in closed form, in terms of algebraic functions. The solution obtained yields a local behavior corresponding to the unbounded-space solution. The unbounded-space problem was superposed on secondary fields so as to satisfy the boundary conditions. The secondary fields are obtained by the method of the differential transform. Author

N77-25581*# Lockheed-California Co., Burbank.
EVALUATION OF STRUCTURAL DESIGN CONCEPTS FOR AN ARROW-WING SUPERSONIC CRUISE AIRCRAFT
I. F. Sakata and G. W. Davis Washington NASA Apr. 1977 138 p refs
(Contract NAS1-12288)
(NASA-CR-2667; LR-27832) Avail: NTIS HC A07/MF A01 CSCL 01C

An analytical study was performed to determine the best structural approach for design of primary wing and fuselage structure of a Mach 2.7 arrow wing supersonic cruise aircraft. Concepts were evaluated considering near term start of design. Emphasis was placed on the complex interactions between thermal stress, static aeroelasticity, flutter, fatigue and fail safe design, static and dynamic loads, and the effects of variations in structural arrangements, concepts and materials on these interactions. Results indicate that a hybrid wing structure incorporating low profile convex beaded and honeycomb sandwich surface panels of titanium alloy 6Al-4V were the most efficient. The substructure includes titanium alloy spar caps reinforced with boron polyimide composites. The fuselage shell consists of hat stiffened skin and frame construction of titanium alloy 6Al-4V. A summary of the study effort is presented, and a discussion of the overall logic, design philosophy and interaction between the analytical methods for supersonic cruise aircraft design are included. Author

N77-25582# Bari Univ. (Italy). Ist. di Costruzione di Macchine.
A STATISTICAL PROCEDURE FOR RE-ANALYSING FATIGUE-TEST-RESULTS, APPLIED TO WELDED JOINTS IN Al Zn Mg1, Al Zn4 Mg1 AND Al Mg Si
B. Atzori and A. Trentadue [1976] 11 p refs Transl. into ENGLISH from Riv. Ital. della Saldatura (Genoa), no. 6, 1975 p 349-358
(IIW-13-792-76) Avail: NTIS HC A02/MF A01

A new procedure for analyzing experimental fatigue results for welded joints was applied to several kinds of aluminum alloys. The same scatter-band computed in a previous work for welded joints in Al Mg5 was found to be valid for all the considered aluminum alloys and joint geometries. Figures of the fatigue strength are given for several kinds of welded joints and testing conditions. Author (ESA)

N77-25583# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
CALCULATION OF NONSTEADY THERMAL STRESSES IN SKIN-WEB JOINTS FOR HEATING ARBITRARY IN TIME [BERECHNUNG INSTATIONAERER THERMISCHER SPANNUNGEN IN HAUT-STEG-VERBINDUNGEN BEI ZEITLICH BELIEBIGER AUFHEIZUNG]
Christoph Haberland and Koehler 1976 44 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft
(ILR-16; ISBN-3-7983-0568-4) Avail: NTIS HC A03/MF A01

A method is formulated for determining thermal stresses in skin-web joints, for which the nonlinear temperature distributions in the elasticity equation are calculated semi-analytically. This allows treatment of arbitrary time boundary conditions in heat flux systems and in convective systems. The thermal resistance of a joint between skin and web can be included in the calculation. The stress analysis is carried out for four representative structural elements (angle profile, T profile, U profile, double T profile). Several examples were calculated for selected boundary conditions and geometries in order to test the method. ESA

N77-25584# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
USER'S MANUAL OF ARREST. A COMPUTER ROUTINE FOR PREDICTION OF RESIDUAL STRENGTH OF CRACKED STIFFENED PANELS
H. Vlieger and A. Sanderse Sep. 1975 135 p refs
(Contract NIVR-1705)
(NLR-TR-75129-U) Avail: NTIS HC A07/MF A01

A detailed description is given of the computer program ARREST and of the execution of it in determining the residual strength diagram of cracked stiffened panels. The essentials of the computer program are dealt with whereas the derivation of the equations together with the program flow charts and the program listing are given in appendices. An example of computation is given to illustrate the preparation of the computer input and the treatment of the computer output data in order to determine the residual strength diagram. The procedure to find the fail-safe stress level from this residual strength diagram is outlined in a reference which accompanies this user's manual. Author (ESA)

N77-25585# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PHENOMENOLOGICAL RELATIONS FOR THE PREDICTION OF LOW CYCLE FATIGUE
Jean Lemaitre Mar. 1977 33 p refs In FRENCH; ENGLISH summary Presented at the GAMI Conf. on 'La Fatigue Oligocyclique', St. Ouen, France, 17 Mar. 1976 Report will also be announced as translation (ESA-TT-402)
(ONERA-NT-1977-3; FR-ISSN-0078-3781) Avail: NTIS HC A03/MF A01

The effect of structural calculations on the accuracy of prediction of fatigue rupture was indicated, and the damage concept developed in order to give a unified approach to failure. The Manson-Coffin relation, strainrange partitioning method and a model of nonlinear cumulation and interaction were established from this concept of damage and described with a view to defining their range of applications. Author (ESA)

N77-25586# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.
CRITICAL LITERATURE REVIEW OF CALCULATION AND DESIGN METHODS OF CYLINDRICAL SHELLS UNDER EXTERNAL PRESSURE
William Provost Feb. 1977 44 p refs Sponsored by the Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-MT-117) Avail: NTIS HC A03/MF A01

A survey of various analytical formulas for the elastic buckling of cylindrical shells is presented. The collapse pressure calculated from these formulas is compared with some experimental data. Design methods given by the current pressure vessel and boiler codes are discussed and their relation to the theoretical and empirical formulas indicated. A comparison is made between some design pressures calculated from the various codes. ESA

N77-25587# California Univ., Los Angeles. School of Engineering and Applied Science.
FRACTURE STATISTICS OF BRITTLE MATERIALS WITH SURFACE CRACKS Technical Report, 1976 - 1977
S. B. Batdorf, H. L. Heinisch, Jr., and W. J. Knapp Jan. 1977 39 p refs Sponsored in part by AFOSR
(Contract N00014-76-C-0445)
(AD-A036142; UCLA-ENG-7703) Avail: NTIS HC A03/MF A01 CSCL 11/2

Several different statistical fracture theories are developed for materials with cracks confined to the surface. All assume that crack planes are normal to the surface, but are otherwise randomly oriented. The simplest theory assumes that only the component of stress normal to the crack plane contributes to fracture. This theory is in fair agreement with biaxial fracture data on pyrex glass obtained by Oh. When the contribution of shear is included in the analysis, the crack shape has to be considered. Several shapes are examined, and the corresponding fracture statistics are derived. The failure criterion employed is that fracture occurs when the maximum tensile stress on some part of the crack surface reaches the intrinsic strength of the material. The assumption of shear-sensitive cracks leads to improved agreement with experiment, but really good agreement appears to require the assumption that the cracks have a preferred orientation. Author (GRA)

N77-25588# California Univ., Berkeley.
NONLINEAR ANALYSIS OF REINFORCED CONCRETE PANELS, SLABS AND SHELLS FOR TIME DEPENDENT EFFECTS Ph.D. Thesis
Ahmad Fazlul Kabir Dec. 1976 250 p refs
(Grant NSF ENG-74-02658)
(PB-264116/5; UCSESM-76-6) Avail: NTIS HC A11/MF A01 CSCL 13M

A numerical method of analysis is developed to trace the quasistatic responses of various types of reinforced concrete structures, of practical interest, under sustained load conditions. Time dependent environmental phenomena, such as creep and shrinkage effects, are considered to obtain the evolution of the field variables of such structures in elastic and inelastic regimes. Ultimate collapses of shear panels, slabs of arbitrary geometry, and free-form shell-type structures are then predicted considering local failures in steel and concrete along with the deterioration of structure stiffness due to progressive cracking. GRA

N77-25589# Forest Products Lab., Madison, Wis.
EFFECT OF DURATION AND RATE OF LOADING ON STRENGTH OF WOOD AND WOOD-BASED MATERIALS
Charles C. Gerhards 1977 27 p refs
(AD-A035632; FSRP-FPL-283) Avail: NTIS HC A03/MF A01 CSCL 11/12

This study reviews world literature on the strength-related effect of duration and rate of loading on wood and wood-based materials. Also, early developments are discussed which led to the currently used permanent loading factor of 9/16. Published data on duration of load are reanalyzed and compared. The comparisons suggest that the effect of stress level on duration of stress for wood is greater for shear than for bending or compression. The comparisons also suggest that the stress level effect is greater in hardboard, particle board, and plywood than in solid wood. A similar comparison of loading rate effects suggests that strength is affected to a greater extent in green wood than in dry wood, particularly in bending. For dry wood, the effect of loading rate on strength is most pronounced in tension perpendicular to grain, followed by compression parallel to grain, bending, and shear. Results also suggest that loading rate in bending has a slightly greater effect on hardboard strength and a slightly lesser effect on particle board strength compared to strength of wood. The shortcomings of the present data on loading rate and duration are discussed. Suggestions are made for needed research. Author (GRA)

N77-25590# Watervliet Arsenal, N.Y.
STRESS INTENSITY FACTORS FOR A PRESSURIZED THICK-WALL CYLINDER WITH A PART-THROUGH CIRCULAR SURFACE FLAW: COMPLIANCE CALIBRATION AND COLLOCATION METHOD
M. A. Hussain, J. F. Throop, S. L. Pu, and R. D. Scanlon Oct. 1976 60 p refs
(DA Proj. 1T1-61102-AH-54)
(AD-A033370; WVT-TR-76040) Avail: NTIS HC A04/MF A01 CSCL 20/11

The K calibration at the deepest point of a circular surface flaw in an internally pressurized thick-walled cylinder has been determined by a compliance test as well as a three-dimensional collocation method. Compliance is defined as the change in the internal volume of a cylinder divided by an applied hydrostatic pressure instead of the usual elongation/load definition. It is shown, using the linear theory of elasticity, that the derivative with respect to the crack depth of internal and external volume changes is identical. This permits the use of external strain measurements to compute the stress intensity factors. Periodic cubic splines are used to interpolate/approximate the strain data as well as to compute external volume changes as a function of crack depth. The results agree very well with theoretical results obtained by the three-dimensional collocation method. Author (GRA)

N77-25591# Cornell Univ., Ithaca, N.Y. Dept. of Structural Engineering.
THE BEHAVIOR OF PLAIN CONCRETE SUBJECT TO BIAXIAL STRESS Final Report
Mohammed E. Tasuji, Arthur H. Nilson, and Floyd O. Slate Mar. 1976 185 p refs
(Grant NSF GK-31470)
(PB-262258/7; Rept-360) Avail: NTIS HC A09/MF A01 CSCL 13C

Strength and deformational characteristics of concrete have been studied experimentally, and the failure mechanism of concrete has been considered both at ultimate load and at the discontinuity level. Previous biaxial studies of concrete are reviewed, and various problems associated with the techniques of testing are discussed. GRA

N77-25592# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
ANALYSIS OF ORTHOTROPIC, LAMINATED SHELLS WITH SHEAR DEFORMATIONS
Charles M. Eldridge and J. C. Huang 29 Oct. 1976 34 p refs
(AD-A034406; RL-77-1) Avail: NTIS HC A03/MF A01 CSCL 13/13

A curved finite element is developed for the analysis of a laminated, axisymmetric shell of revolution with transverse shear deformation. The element stiffness relations are obtained from the principle of minimum potential energy. The shell displacements represent four degrees of freedom at a node, two translation, and two rotation. Author (GRA)

N77-25593# State Univ. of New York, Buffalo. Dept. of Engineering Science.
TIME HARMONIC ACOUSTIC RADIATION FROM A SUBMERGED ELASTIC SHELL DEFINED BY NONCONCENTRIC CYLINDERS
Richard Paul Shaw Sep. 1976 50 p refs
(Contract N00014-76-C-0302)
(AD-A034886; Rept-97) Avail: NTIS HC A03/MF A01 CSCL 20/1

The acoustic radiation from an elastic cylindrical shell defined by nonconcentric cylindrical surfaces and submerged in an acoustic fluid is studied. The driving mechanism is a time harmonic internal pressure. In particular, the influence of the nonconcentricity parameter, delta, on the resulting radiation field is examined. The solution is obtained by means of an expansion in powers of this parameter about the concentric solution, delta = 0. Each order of solution is solved in closed form by means of boundary integral equation methods. Results are given for the zeroth and first order solutions and it is seen that a jth driving mode will introduce nearest neighbor (j-1) and (j-1) modes in the first order solution. Author (GRA)

N77-25594# California Univ., Berkeley. Earthquake Engineering Research Center.
ANALYSIS AND DESIGN OF NUMERICAL INTEGRATION METHODS IN STRUCTURAL DYNAMICS
Hans M. Hilber Nov. 1976 102 p refs Sponsored in part by

the German Minister fuer Technologie und Forschung
(PB-264410/2; EERC-76-29) Avail: NTIS HC A06/MF A01 CSCL 13M

One-step methods were developed for the integration of the equations of structural dynamics which are: (1) unconditionally stable, (2) have an order of accuracy not less than two, and (3) possess numerical dissipation which can be controlled by a parameter other than the time step size. In particular, no numerical dissipation must be included. Four new families of algorithms are discussed from this point of view, and compared with algorithms, such as the Newmark, Wilson and Houbolt methods, which are commonly used in structural dynamics and do not achieve these requirements. GRA

N77-25595# California Univ., Berkeley. Earthquake Engineering Research Center.
SENSITIVITY ANALYSIS FOR HYSTERETIC DYNAMIC SYSTEMS: THEORY AND APPLICATIONS
D. Ray, K. S. Pister, and E. Polak Feb. 1976 62 p refs
(Grant NSF AEN-73-07732-A02)
(PB-262859/2; EERC-76-12) Avail: NTIS HC A04/MF A01 CSCL 13M

General results are presented for nonlinear (hysteretic) structures, and explicit numerical examples illustrate the methodology applied to multi-story shear frames whose force-displacement relationship is bilinear hysteretic. GRA

N77-25596# Illinois Univ., Urbana-Champaign. Dept. of Civil Engineering.
BEHAVIOR OF TEN-STORY REINFORCED CONCRETE WALLS SUBJECTED TO EARTHQUAKE MOTIONS
J. Dario Aristizabal-Ochoa and Mete A. Sozen Oct. 1976 397 p refs
(Grant NSF ATA-74-22962)
(PB-262950/9; UILU-ENG-76-2017; Ser-431) Avail: NTIS HC A17/MF A01 CSCL 13M

The response of ten-story reinforced concrete walls coupled by beams to earthquake base motions was investigated through experimental and anaiytical models. Each test structure, consisting of two identical specimens parallel to each other and oriented such that the base motion caused them to bend about their strong axis, carried dead weight at each of the ten levels. The main variables in the experimental work were the strength of the test structures and the base motions. Measurements included horizontal acceleration at 22 locations and horizontal displacements at 20 locations. GRA

N77-25597# Sydney Univ. (Australia). Civil Engineering Labs.
PORTAL FRAME TESTS WITH OUT-OF-PLANE DEFORMATIONS
Gregory J. Hancock Aug. 1976 39 p refs
(PB-262326/2; R-292) Avail: NTIS HC A03/MF A01 CSCL 13M

Tests of four pitched roof portal frames which were less heavily restrained laterally and torsionally than would be required for an in-plane plastic collapse are described. Measurements of frame imperfections including residual strains, out-of-plane geometric imperfections, and lack of fit moments are included in the results. The in-plane load-deflection response for a series of loadings and unloadings is presented. The measured in-plane bending moment distribution is compared with that calculated from a linear analysis. Graphs of the lateral deflections of the frames are shown for the tests in which the frames were loaded to destruction. Conclusions concerning the failure modes of structures of this type are presented. GRA

N77-25598# Sydney Univ. (Australia). Civil Engineering Labs.
NON-LINEAR BEHAVIOR ADJACENT TO COLUMNS OF COMPOSITE FRAMES
P. Ansourian Sep. 1976 41 p refs Sponsored in part by the Australian Road Res. Board
(PB-262325/4; R-293) Avail: NTIS HC A03/MF A01 CSCL 13M

The nonlinear behavior of composite beams framing into composite columns is examined. A numerical analysis is presented which includes the effects of cracking, nonlinear slip between joist and slab caused by a flexible shear connection, and development of yielding and strain hardening of the steel. Predictions of the analysis are compared with observed behavior in 13 composite subunits. Provided secondary failures of the slab or connection are prevented, the ultimate strength and rotation capacity at the face of the column are limited by lateral buckling of the compression flange. GRA

N77-25599# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.
AN ULTRASONIC TECHNIQUE FOR DETECTION OF THE ONSET OF FATIGUE DAMAGE Final Report, 1 Mar. 1971 - 28 Feb. 1976
Robert E. Green, Jr. and Robert B. Pond, Sr. Apr. 1976 26 p refs
(Contract F44620-71-C-0062)
(AD-A035578; AFOSR-76-0811TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The primary purpose of this research was to develop an optimum ultrasonic technique for the early detection of fatigue damage. It is concluded that the optimum ultrasonic technique for early detection of fatigue damage is a technique which permits simultaneous measurements of acoustic emission activity and ultrasonic attenuation changes. GRA

N77-25600# Technion - Israel Inst. of Tech., Haifa. Material Mechanics Lab.
A HARDNESS LAW FOR INELASTIC DEFORMATION Interim Report
S. R. Bodner Nov. 1976 25 p refs
(Grant AF-AFOSR-2607-74)
(AD-A035577; MML-52; AFOSR-77-0058TR; SR-10) Avail: NTIS HC A02/MF A01 CSCL 20/11

Certain formulations of elastic-viscoplastic constitutive equations lead to inelastic deformations being governed by a functional relation between the plastic deformation rate and the stress. This relation is taken to be unique, continuous function at a constant microstructural condition specified by certain state variables. On the assumption that a single state variable referred to as hardness is adequate to represent overall resistance to plastic flow, the problem becomes one of determining evolutionary equations for the dependence of the hardness parameter on loading history. A procedure for calculating hardness changes for general multiaxial loading histories is proposed in this paper. Stress-strain relations that would be predicted by this procedure appear to be consistent with experimental results for various multiaxial loading histories including proportional and non-proportional cyclic loading. Author (GRA)

N77-25601# Materials Research Lab., Inc., Glenwood, Ill.
FRACTURING CHARACTERISTICS OF ADHESIVE JOINTS Final Report, 16 Jan. 1975 - 16 Jan. 1976
Sheldon Mostovoy and E. J. Ripling Nov. 1976 62 p refs
(Contract N00019-75-C-0271)
(AD-A035382) Avail: NTIS HC A04/MF A01 CSCL 13/5

This report is one of a series describing the fracturing characteristics of adhesive joints and is divided into two main sections. The first section describes mixed-mode specimen development and testing, and the second describes the elevated temperature stress corrosion cracking (SCC) resistance of a commercial adhesive. GRA

N77-25602# Naval Ship Research and Development Center, Bethesda, Md.
A COMPUTER PROGRAM FOR CALCULATION OF THE RESIDUAL STRESS DISTRIBUTION AND THE EFFECTIVE STRESS-STRAIN CURVE OF COLD-FORMED STRUCTURAL MEMBERS Final Report
Robert K. Tacey Nov. 1976 79 p refs
(SF43422502)
(AD-A034996; DTNSRDC-76-0141) Avail: NTIS HC A05/MF A01 CSCL 13/13

This report describes a computer program which can be used to calculate the cross sectional residual stress distribution and the effective compressive stress-strain relationship of a cold formed structural number. The program is user oriented and requires input of only basic geometry and base metal stress-strain data. The program is general as to the shape of the cross section

that may be analyzed. It accounts for inelastic material behavior during initial bending and during springback. Strain hardening and unequal compressive and tensile material stress-strain relationships are included in the analysis. Material properties are homogeneous and isotropic within the individual elements. However, they may vary from element to element. The Bauschinger Effect can be accounted for by utilizing non-dimensional experimental data or theoretical formulations. These different methods may be inserted in the program in modular fashion. The program can analyze the forming process as an operation consisting of up to ten individual bends. Graphs are presented that show close agreement between the program predictions and limited experimental results. Author (GRA)

N77-25603# Naval Postgraduate School, Monterey, Calif.
STATIC AND DYNAMIC BUCKLING OF SHALLOW SPHERICAL SHELLS SUBJECTED TO AXISYMMETRIC AND NEARLY AXISYMMETRIC STEP-PRESSURE LOADS USING SATANS-2A, A MODIFIED VERSION OF SATANS-2 M.S. Thesis
Michael D. Shutt Dec. 1976 168 p refs
(AD-A035911) Avail: NTIS HC A08/MF A01 CSCL 20/11

A digital computer program for the geometrically nonlinear analysis of totally arbitrarily loaded shells of revolution SATANS-2 was modified to more accurately account for the conditions at the pole of the shell. This program was used to determine the buckling load of shallow spherical shells of various sizes when subjected to static axisymmetric, dynamic axisymmetric, and dynamic nearly axisymmetric step-pressure loads of infinite duration. A comparison was made between the new buckling results and previous results obtained without the new pole routine. The comparison revealed a significant change in the buckling pressures, due solely to the change in the pole routine. The new static axisymmetric, dynamic axisymmetric, and even the dynamic asymmetric critical buckling pressure loads appear to be fairly reliable results for perfect, shallow shells. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N77-25604*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
A PRELIMINARY TRAINING GUIDE FOR UTILIZING HIGH-ALTITUDE, COLOR-INFRARED PHOTOGRAPHY IN COMPILING SOIL MAPS
J. E. Weaver, W. H. Parkhurst, J. F. Ward, and R. H. Almond Apr. 1977 113 p refs
(Contract NAS9-15200)
(NASA-CR-151420; LEC-8283) Avail: NTIS HC A06/MF A01 CSCL 08B

Instruction for acquiring and analytically processing small-scale color-infrared photography to perform a soil resources inventory over forests of the southern U.S. is provided. Planning the project; acquiring aerial photography, materials, equipment and supplemental data; and preparing the photography for analysis are discussed. The procedures for preparing ancillary and primary component overlays are discussed. The use of correlation charts and dichotomous keys for mountain landforms, water regime, and vegetation is explained. Author

N77-25605*# Bittinger (M. W.) and Associates, Inc., Fort Collins, Colo.
SNOWPACK GROUND TRUTH DONNER PASS SITE, SODA SPRINGS, CALIFORNIA Mission Report, 18 Jan. 1977
E. Bruce Jones Feb. 1977 14 p Original contains color illustrations
(Contract NAS5-22312)
(NASA-CR-152532) Avail: NTIS HC A02/MF A01 CSCL 08L

Ground truth data taken near Soda Springs, California, on January 18, 1977, in support of the NASA Airborne Instrumentation Research Program are presented. Ground truth data taken in support of this mission were as follows: (1) snow depths were taken every 400 feet; (2) snow densities were taken every 1,200 feet; (3) two snowpits were dug, and limited density, vertical layer classifications, and soil observations were taken; and (4) temperatures of the upper 6 inches of the snowpack were taken at one location. Author

N77-25606*# Kansas State Univ., Manhattan.
RESPONSE OF WINTER AND SPRING WHEAT GRAIN YIELDS TO METEOROLOGICAL VARIATION Final Report
Arlin M. Feyerherm, Edward T. Kanemasu, and Gary M. Paulsen Feb. 1977 142 p refs
(Contract NAS9-14282)
(NASA-CR-151429) Avail: NTIS HC A07/MF A01 CSCL 02C

Mathematical models which quantify the relation of wheat yield to selected weather-related variables are presented. Other sources of variation (amount of applied nitrogen, improved varieties, cultural practices) have been incorporated in the models to explain yield variation both singly and in combination with weather-related variables. Separate models were developed for fall-planted (winter) and spring-planted (spring) wheats. Meteorological variation is observed, basically, by daily measurements of minimum and maximum temperatures, precipitation, and tabled values of solar radiation at the edge of the atmosphere and daylength. Two different soil moisture budgets are suggested to compute simulated values of evapotranspiration; one uses the above-mentioned inputs, the other uses the measured temperatures and precipitation but replaces the tabled values (solar radiation and daylength) by measured solar radiation and satellite-derived multispectral scanner data to estimate leaf area index. Weather-related variables are defined by phenological stages, rather than calendar periods, to make the models more universally applicable. Author

N77-25607*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING INPUTS TO LANDSCAPE MODELS WHICH PREDICT FUTURE SPATIAL LAND USE PATTERNS FOR HYDROLOGIC MODELS
Lee D. Miller, Craig Tom, and Kaew Nualchawee May 1977 49 p refs Sponsored in part by the US Dept. of Interior, the United Nations, Colo. State Univ., and Kasetsart Univ., Bangkok, Thailand
(NASA-TM-X-71330; X-923-77-115) Avail: NTIS HC A03/MF A01 CSCL 08B

A tropical forest area of Northern Thailand provided a test case of the application of the approach in more natural surroundings. Remote sensing imagery subjected to proper computer analysis has been shown to be a very useful means of collecting spatial data for the science of hydrology. Remote sensing products provide direct input to hydrologic models and practical data bases for planning large and small-scale hydrologic developments. Combining the available remote sensing imagery together with available map information in the landscape model provides a basis for substantial improvements in these applications. Author

N77-25608# World Meteorological Organization, Geneva (Switzerland).
AN EVALUATION OF CLIMATE AND WATER RESOURCES FOR DEVELOPMENT OF AGRICULTURE IN THE SUDANO-SAHELIAN ZONE OF WEST AFRICA
E. G. Davy, F. Mattei, and S. I. Solomon 1976 303 p refs Prepared in cooperation with UN Environ. Program
(WMO-459; SER-9; ISBN-92-63-10459-X) Avail: NTIS HC A14/MF A01; WMO, Geneva

A comprehensive background of summarized hydrometeoro-

logical data and methodologies for practical application in agricultural planning and management in Mauritania, Senegal, Gambia, Mali, Upper Volta, Niger, and Czad is presented. Physiography, posts, land cover, and land use of the region are described together with the general climatological pattern. The hydrological characteristics of the zone are noted, and the relation of crop yields and rainfall and rain flow is discussed. Tables give results of measurements of various parameters in 27 agroclimatic areas of the zone, and these are discussed. ESA

N77-25609# Naval Training Equipment Center, Orlando, Fla. Electronics and Acoustics Lab.
PERI-APOLLAR 360 DEGREE LENS DISTORTION FREE LINEAR MAPPING Interim Report, Nov. - Dec. 1976
John C. McKechnie Feb. 1977 34 p refs
(ZF55522002)
(AD-A036150; NAVTRAEQUIPC-TN-55) Avail: NTIS HC A03/MF A01 CSCL 20/6

Several methods, including fiber-optics are considered for producing a distortion free linear image transfer at both the optical probe and projection lens image planes of 360 deg nonprogrammed visual display. A description of five methods is given and each alternative examined analytically. Author (GRA)

N77-25610# Colorado State Univ., Fort Collins. Environmental Resources Center.
DETERMINATION OF SNOW DEPTH AND WATER EQUIVALENT BY REMOTE SENSING Final Report
Harold W. Steinhoff and Albert H. Barnes Jun. 1976 21 p
(Contracts DI-14-31-0001-3806; D1-14-31-0001-4006)
(PB-264229/6; W77-05104; OWRT-A-019-COLO(2)) Avail: NTIS HC A02/MF A01 CSCL 08L

By measuring the melt date and environmental variables, one could predict snow depth and water equivalent, once these equations were established for a given area. Melt date can be measured by observation from two aerial flights at three-day intervals in early spring. It is concluded that determination of snow depth and water equivalent by remote sensing from aircraft is possible. GRA

N77-25611# Geological Survey, Anchorage, Alaska. Water Resources Div.
WATER RESOURCES DATA FOR ALASKA. WATER YEAR 1975 Water-Data Report, 1 Oct. 1974 - 30 Sep. 1975
Dec. 1976 424 p
(PB-264228/8; USGS-WDR-AK-75-1;
USGS-WRD-HD-76-0050) Avail: NTIS HC A18/MF A01 CSCL 08H

Water resources data for the 1975 water year for Alaska consist of records of stage, discharge, and water quality of streams; stage and water quality of lakes; and water levels and water quality in wells and springs. This report contains discharge records for 107 gaging stations; stage only records for 2 gaging stations; water quality for 31 stations; and water levels for 19 observation wells. Also included are 85 creststage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alaska. GRA

N77-25612*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROGRAM DEFINITION FOR THE DEVELOPMENT OF GEOTHERMAL ENERGY. VOLUME 1: BACKGROUND AND PROGRAM DEFINITION SUMMARY
29 Aug. 1975 59 p refs Sponsored in part by ERDA 3 Vol.
(Contract NAS7-100)
(NASA-CR-15322; PB-263833/6; NSF/RA/N-75-338A-Vol-1; JPL-5040-6-Vol-1) Avail: NTIS HC A04/MF A01; also avail. in set of 3 reports HC E10, PB-263832-SET CSCL 08I

Federal Government actions proposed to facilitate a significant acceleration in the commercial utilization of the nation's valuable geothermal energy resources, in an environmentally acceptable manner, are reported. The utilization level that might be achieved by 1985 and beyond, as a result of an effective Federal Government program to facilitate industrial development of geothermal energy, is projected. Existing barriers to that development are discussed, and the three basic steps to development are presented. Development strategy adopted and detailed requirements for growth are included. GRA

N77-25613*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROGRAM DEFINITION FOR THE DEVELOPMENT OF GEOTHERMAL ENERGY. VOLUME 2: PROGRAM DEFINITION DEVELOPMENT RATIONALE AND SUBPROGRAM DESCRIPTIONS
29 Aug. 1975 250 p refs Sponsored in part by ERDA 3 Vol.
(Contract NAS7-100)
(NASA-CR-153222; PB-263834/4;
NSF/RA/N-75-338B-Vol-2; JPL-5040-6-Vol-2) Avail: NTIS HC A11/MF A01; also avail. in set of 3 reports HC E10, PB-263832-SET CSCL 08I

The objectives and the goal of the program are defined, and the expected sequence for commercialization of various resource types is presented. Needed technology demonstrations are outlined, and the major problems associated with obtaining rapid growth in utilization of these resources are identified. The scope of actions readily available to the government are specified. Basic strategy for program development as an effort to get the private sector moving, and to sustain it until it gathers sufficient momentum to become self-sustaining is outlined. The overall subprogram descriptions and the detailed rationale for each of the recommended actions is provided. Author

N77-25614*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROGRAM DEFINITION FOR THE DEVELOPMENT OF GEOTHERMAL ENERGY. VOLUME 3: APPENDIXES
29 Aug. 1975 411 p Sponsored in part by ERDA 3 Vol.
(Contract NAS7-100)
(NASA-CR-153223; PB-263835/1;
NSF/RA/N-75-338C-Vol-3-App; JPL-5040-6-Vol-3) Avail: NTIS HC A18/MF A01; also avail. in set of 3 reports HC E10, PB-263832-SET CSCL 08I

The following appendixes are provided; Implications of the 1985 Goal and Updated Sensitivity Analysis; Geothermal Development Timelines; Leasing and Exploration; Research and Development; Electric Utilities; Nonelectric Geothermal Market; Geopressured Resource Research and Development; Community Planning; Summary of ERDA Patent Policy Relevant to Geothermal Energy; Factors Affecting the Development of Known Geothermal Prospects; Environmental Laws and Regulations; An Elementary Treatment of Economics of Geothermal Power Production; Conversion Cycle Analysis; Projection of Attainable Geothermal Energy Development and Use; and Geothermal Energy Research, Development, and Demonstration Act of 1974. GRA

N77-25615# Army Engineer Topographic Labs., Fort Belvoir, Va.
CAPABILITIES OF REMOTE SENSORS TO DETERMINE ENVIRONMENTAL INFORMATION FOR COMBAT
Jack N. Rinker, Judy Ehlen, Alan E. Krusinger, Thomas R. Currin, and Ambrose O. Poulin Nov. 1976 247 p
(DA Proj. 4A1-61102-B-52C)
(AD-A035139; ETL-0081) Avail: NTIS HC A11/MF A01 CSCL 15/4

U.S. Army Field and Technical Manuals were used to develop a list of 313 environmental information needs, or factors, required by the Army to accomplish its various tasks. Each factor was evaluated against a list of remote sensing systems to determine the extent to which each system could provide the needed information. Interpretation procedures were restricted to evaluation of imagery by conventional interpretation techniques and equipment. The systems evaluated are LANDSAT (ERTS), radar, thermal infrared, low-level oblique photography, standard photo index sheets, stereo 1:100,000 scale vertical aerial photography, and stereo 1:20,000 scale vertical aerial photography. GRA

N77-25616# Army Engineer Topographic Labs., Fort Belvoir, Va.
PHOTO ANALYSIS OF A DESERT AREA
Judy Ehlen Apr. 1976 74 p refs
(DA Proj. 4A1-61102-B-52D)
(AD-A035481; ETL-0068) Avail: NTIS HC A04/MF A01 CSCL 08/6

Information derived from 1:9,600 scale stereoscopic aerial

photography of a desert area near Yuma, Arizona, is presented. Physiography, geology, climate, landform, drainage, erosional aspects, vegetation, and cultural features are considered in the context of local and regional environmental, engineering, and military considerations. The second part of this report presents a field verification of the general geology, geomorphology, and vegetation in the study area with a list of selected references.
Author (GRA)

N77-25617# Control Data Corp., Minneapolis, Minn. Image Systems Div.
DIGITAL CARTOGRAPHIC STUDY AND BENCHMARK Interim Technical Report
D. J. Panton and M. E. Murphy Sep. 1976 44 p
(Contract DAAG53-75-C-0195)
(AD-A035157; ETL-0092; IR-3) Avail: NTIS HC A03/MF A01 CSCL 08/2

The work and findings of Phase C are to implement and test--on fast, microprogrammable processors--the stereo matching algorithm that was designed and analyzed in AD's A035 155 and A035 156. This implementation was performed in terms of a benchmark to shed some light on the practicality of such a concept and to uncover the advantages and disadvantages of this particular kind of parallel processing application. The results stem from actually performing the benchmark rather than from a paper study outlining the approach to be taken. The benchmark was evaluated both in terms of its speed and accuracy. It was found that it takes about 11 hours of CDC 6600 processing to complete the correlation and matching of a typical 9x9 inch frame stereo overlap area, while the benchmark implementation can process the same area in a little over one-half hour. GRA

N77-25618# Army Engineer Topographic Labs., Fort Belvoir, Va.
HOLOGRAPHIC TERRAIN DISPLAYS
Michael M. McDonnell Oct. 1976 54 p refs
(DA Proj. 4A1-61102-B-52C)
(AD-A035154; ETL-0083) Avail: NTIS HC A04/MF A01 CSCL 08/2

The suitability of holography as a method for recording and reproducing visual displays of terrain is examined in a tutorial, non-mathematical manner. The paper is based chiefly on a literature search combined with some original work by the author. A brief introduction to the terminology of holography is followed by an exposition of a scheme of classifying hologram types which is used in the rest of the paper. Consideration of requirements for 3-D displays in general and the particular problem of making holograms of terrain is followed by a detailed discussion of the different types of hologram and how they may be used to make terrain displays with different characteristics. Emphasis is on the 2-photograph stereoscopic hologram which is called a 'holographic stereomodel'. Techniques to enhance certain characteristics of holographic displays such as color rendition and efficient use of illumination are examined and possible uses of holography in tasks related to map making are suggested. GRA

N77-25619# Tel-Aviv Univ. (Israel).
CONFORMAL MAPPINGS AND BOUNDARY VALUE PROBLEMS Final Technical Report, Jul. 1975 - Oct. 1976
J. Burbea, A. Ghandour, and R. Mandelbaum Oct. 1976 27 p refs
(Grant DA-EPRO-124-74-G0069)
(AD-A036084) Avail: NTIS HC A03/MF A01 CSCL 12/1

Three principal areas of investigation are as follows: (1) Kernel functions and related areas. Results have been obtained on polynomial density in Bers Spaces, Berman Spaces over multiply-connected domains, Total Positively and reproducing kernels, Szego kernels and the Riesz projection theorem and Metric on Annuli, (2) BVP (Boundary Value Problems), and IVP (Initial Value Problems). Study has been undertaken of transforming BVP into IVP. In particular, a method whereby a well-posed elliptic boundary-value problem of the Dirichlet type is transformed into a first-order non-linear equation governing the Green's function of an embedded problem is studied, and (3) Singularities. The study of smoothings of analytic singularities is discussed. In particular, generalized complete intersections and their spaces of deformations are analyzed. GRA

N77-25620# State Univ. of New York, Albany. Atmospheric Sciences Research Center.
US IFYGL COASTAL CHAIN PROGRAM. REPORT 2: TRANSPORT, CURRENTS AND TEMPERATURE FROM THE UNITED STATES AND CANADIAN COASTAL CHAIN STUDIES
Dennis R. Landsberg and Jon T. Scott Aug. 1976 225 p refs
(Grants NOAA-2-35388; NOAA-2-35281)
(PB-263829/4; ASRC-Pub-387; NOAA-77010403) Avail: NTIS HC A10/MF A01 CSCL 08H

Limnologists are provided with several kinds of summarized temperature, velocity, and transport data for the five coastal chains combined. The introductory text provides a review of the measurement techniques including assessment of data accuracy plus the methods of calculation used in the report and the limitations that should be placed on use of the data. GRA

N77-25621# National Weather Service, Silver Spring, Md. Hydrologic Research Lab.
CATCHMENT MODELING AND INITIAL PARAMETER ESTIMATION FOR THE NATIONAL WEATHER SERVICE RIVER FORECAST SYSTEM
Eugene L. Peck Jun. 1976 86 p refs
(PB-264154/6; NOAA-TM-NWS-HYDRO-31-DOC; NOAA-76081102; NOAA/DF77-002a) Avail: NTIS HC A05/MF A01 CSCL 08H

A major revision has been made in the soil moisture accounting for the catchment model. The components for soil moisture accounting of the Sacramento Model have replaced those of the modified Stanford Model as used in the original system. The conceptual features and characteristics of the Sacramento Model are discussed. GRA

N77-25622# Scripps Institution of Oceanography, La Jolla, Calif.
PLEIADES EXPEDITION, LEG 04, MN76-01, R/V MELVILLE. PRELIMINARY CRUISE REPORT
F. N. Spiess and J. Greenslate Dec. 1976 99 p refs
(Grants NSF OCE-76-04724; NSF OCE-75-12968)
(PB-264626/3; NSF/IDOE-77-48; NSF/IDOE-Manganese Nodule-15) Avail: NTIS HC A05/MF A01 CSCL 08I

Undersea mineral deposits of manganese nodules were studied. Specific areas selected are representative of a variety of manganese deposition environments and were chosen to be as free of complicating factors as possible. The first area was located at 11 deg N latitude and 140 deg W longitude. It lies in a region of little apparent tectonic activity, is far removed from continental influences, and is within the zone in which the richest nodule deposits occur. The second site (Station 21 on the track chart) was chosen to represent the equatorial Pacific region which has much recent calcareous sediment and is characteristically free of manganese deposits. GRA

N77-25623# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
DIPOLE-DIPOLE RESISTIVITY SURVEYS, ROOSEVELT HOT SPRINGS KGRA, VOLUME 2 Final Report
S. H. Ward and W. R. Sill Jun. 1976 52 p refs
(Grant NSF GI-43741)
(PB-264897/0; NSF/RA-760369) Avail: NTIS HC A04/MF A01 CSCL 08I

Three different dipole spacings were used; 99 km of traverse line were surveyed with 100 m dipoles, 50 km with 300 m dipoles, and 44 km with 1 km dipoles. The resistivity surveys delineated regions of low resistivity associated with fracturing, brines, high temperatures, and clay alteration. The resistivity of rocks that are typical of hydrothermal environments is due to two main conduction mechanisms: electrolytic conduction and porosity of rocks. GRA

N77-25624# TRW Systems and Energy, Redondo Beach, Calif.
IMPROVED MINERAL EXCAVATION NOZZLE DESIGN STUDY Interim Report
P. D. Lohn and D. A. Brent Apr. 1976 104 p
(Contract DI-BM-J0255024)
(PB-264138/9; TRW-27752-6003-TU-00; BM-OFR-33-77) Avail: NTIS HC A06/MF A01 CSCL 08I

The best shape for a borehold mining application consists

of an initial fourth degree polynomial (quartic) at the entrance followed by a straight section with a 20 deg (half-angle) taper at the exit. The techniques developed were used to analyze the performance of a water jet as a function of flow conditions. For a borehold mining application, an operating stagnation pressure of about 2,000 psi is recommended. GRA

N77-25625# Mathtech, Inc., Princeton, N. J.
EVALUATION OF CURRENT SURFACE COAL MINING OVERBURDEN HANDLING TECHNIQUES AND RECLAMATION PRACTICES Final Report
Frank Cook and William Kelly 24 Dec. 1976 320 p refs
(Contract DI-BM-S0144081)
(PB-264111/6; BM-OFR-28-77) Avail: NTIS
HC A14/MF A01 CSCL 08I

An evaluation of mining and reclamation practices at 159 randomly sampled surface coal mines in the United States was conducted. Operating procedures for dragline stripping of single and multiple seams, surface mining of lignite, multicut and multiseam haulback mining on steep slopes, mountaintop removal, and surface mining in swampy or deeply glaciated areas are discussed. Specific candidate research projects are noted. GRA

N77-25626# Rome Air Development Center, Griffiss AFB, N.Y.
AGRICULTURAL CROP YIELD PREDICTION UTILIZING NARROWBAND MULTISPECTRAL, TEMPORALLY REGISTERED IMAGERY (A FEASIBILITY STUDY'S TECHNICAL REPORT AND RECOMMENDATIONS) Report for Jun. 1974 - Jun. 1976
Gregory B. Pavlin Dec. 1976 490 p refs
(AD-A037821; RADC-TR-76-380) Avail: NTIS
HC A21/MF A01 CSCL 02/4

Selected narrowband multispectral photography, dedicated to detecting levels of stress within corn, was collected regularly at low and high altitudes over eight large agricultural test sites in Central Pennsylvania during the period of April thru October of 1974. A spectroradiometry survey was conducted at the test sites during three intervals of the 1974 corn growth cycle to verify the selection of the multispectral camera system's filters. Superlative ground and image truth were collected regularly to supplement the multispectral photography of the test sites. After analyzing the multispectral photography with additive color analysis techniques, selected multispectral photography of three test sites, spanning the entire growth cycle, was digitized and registered, both spectrally and temporally, using the image processing resources of the Rome Air Development Center's Image Processing Facility. By analyzing the digital, temporally-registered, multispectral image data with weather and ground truth data, utilizing the techniques of multivariate and regression analysis, the feasibility of agricultural crop yield prediction was investigated. GRA

N77-25627# PRC Information Sciences Co., McLean, Va.
ACS SYMBOLIZATION FOR DMAAC. VOLUME 1: SYSTEM IMPLEMENTATION AND OPERATION PROCEDURES Final Technical Report, Jun. 1975 - Apr. 1976
Paul D. Bell, John A. Neuffer, and M. Lynn Taylor Griffiss AFB, N. Y. RADC Nov. 1976 70 p 2 Vol.
(Contract F30602-75-C-0319)
(AD-A036014; RADC-TR-76-334-Vol-1) Avail: NTIS
HC A04/MF A01 CSCL 08/2

RADC has implemented a Graphic Line Symbolization System (GLSS) on the Univac 1108 computer system located at the Defense Mapping Agency Aerospace Center (DMAAC). The software accepts data in the DMAAC Linear Input System format and creates symbolized line data for final color separation plotting. Symbols are applied according to Joint Operations Graphics (JOG) specifications. In addition to the lineal symbol capability, the GLSS is capable of creating a significant number of point symbols. The software is written in ASCII, COBOL and FORTRAN 5 languages and requires approximately 40K words of memory for loading and execution of all functions. The software configuration is highly segmented into areas of job set-up, file input, job monitoring, symbol application control, symbol specification, job reporting, and file output. Author (GRA)

N77-25628# PRC Information Sciences Co., McLean, Va.
ACS SYMBOLIZATION FOR DMAAC. VOLUME 2: COMPUTER PROGRAM DOCUMENTATION Final Technical Report, Jun. 1975 - Apr. 1976
Paul D. Bell, John A. Neuffer, and M. Lynn Taylor Griffiss AFB, N. Y. RADC Nov. 1976 342 p 2 Vol.
(Contract F30602-75-C-0319)
(AD-A035993; RADC-TR-76-334-Vol-2) Avail: NTIS
HC A15/MF A01 CSCL 08/2

PRC/ISC, under a RADC contract, converted and expanded the Graphic Line Symbolization System (GLSS) to operate in the production environment at the Defense Mapping Agency Aerospace Center (DMAAC). The system was converted from the HIS-635 to the UNIVAC 1108. Major enhancements to the original software system included additional point symbol capabilities and additional output file formats for interfacing with DMAAC plotter systems. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-25629 British Library Lending Div., Boston Spa (England).
CALCULATION OF THE STATIONARY AND DYNAMIC DISCHARGE BEHAVIOUR OF LEAD ACID BATTERIES
W. Runge Aug. 1976 33 p refs Transl. into ENGLISH from Archiv fuer Elektrotech. (West Ger.), v. 15, no. 57, 1975 p 235-246
(BLL-Trans-3393-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

The approach to the problem and the equivalent circuit are substantially simplified by considering the stationary state and the effect of an alternating component of the current which can be superimposed on that state during load cycles. The characteristic values required for the calculation can be determined from measurements and are indicated for some types of batteries. The conformity of the calculated and the measured behavior is good. Author

N77-25630*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A NICKEL-CADMIUM BATTERY RECONDITIONING CIRCUIT
Roy Lanier Jun. 1977 26 p refs
(NASA-TN-D-8508; M-221) Avail: NTIS HC A03/MF A01 CSCL 10C

The circuit presented is simple and small enough to be included in a typical battery charge/power control assembly, yet provides the advantage of a complete ground-type battery reconditioning discharge. Test results on the circuit when used to recondition two 24 cell, 20 A-h nickel-cadmium batteries are given. These results show that a battery reconditioned with this circuit returns to greater than 90 percent of its original capacity (greater than nameplate capacity) and follows a typical new battery degradation curve even after over 20,000 simulated orbital cycles for a 4 year period. Applications of the circuit are considered along with recommendations relative to its use. Its application in low voltage (22 to 36 Vdc) power systems and in high voltage (100 to 150 Vdc) power systems is discussed. The implications are that the high voltage systems have a greater need for battery reconditioning than their low voltage counterparts, and that using these circuit techniques, the expected life of a battery in low Earth orbit can be up to 5 years. Author

N77-25631*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENT FOR ENERGY SYSTEMS OPTIMIZATION PROGRAM 2 (ESOP2). VOLUME 1: ENGINEERING MANUAL

R. G. Hamil and S. L. Ferden Mar. 1977 53 p refs
(Contract NAS9-15200)
(NASA-CR-151422; LEC-9764-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 10C

The Energy Systems Optimization Program, which is used to provide analyses of Modular Integrated Utility Systems (MIUS), is discussed. Modifications to the input format to allow modular inputs in specified blocks of data are described. An optimization feature which enables the program to search automatically for the minimum value of one parameter while varying the value of other parameters is reported. New program option flags for prime mover analyses and solar energy for space heating and domestic hot water are also covered. Author

N77-25632# Congressional Budget Office, Washington, D. C.
ENERGY RESEARCH: ALTERNATIVE STRATEGIES FOR DEVELOPMENT OF NEW ENERGY TECHNOLOGIES AND THEIR IMPLICATIONS FOR THE FEDERAL BUDGET
15 Jul. 1976 78 p refs
(Paper-10) Avail: SOD HC $1.25

Recognizing the important contribution that research can make to the solution of both short and long range energy problems, Congress has expanded and redirected Federal policies and programs in energy research, development, and demonstration (R,D,&D). It has directed the Energy Research and Development Administration (ERDA) to design a national energy research and development plan and a program for implementing it. Author

N77-25633*# Giner, Inc., Waltham, Mass.
SCREENING OF REDOX COUPLES AND ELECTRODE MATERIALS Final Report
J. Giner, L. Swette, and K. Cahill Sep. 1976 120 p refs Sponsored in part by ERDA
(Contract NAS3-19760)
(NASA-CR-134705) Avail: NTIS HC A06/MF A01 CSCL 10C

Electrochemical parameters of selected redox couples that might be potentially promising for application in bulk energy storage systems were investigated. This was carried out in two phases: a broad investigation of the basic characteristics and behavior of various redox couples, followed by a more limited investigation of their electrochemical performance in a redox flow reactor configuration. In the first phase of the program, eight redox couples were evaluated under a variety of conditions in terms of their exchange current densities as measured by the rotating disk electrode procedure. The second phase of the program involved the testing of four couples in a redox reactor under flow conditions with a varity of electrode materials and structures. Author

N77-25634# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY AND RESOURCE PLANNING GROUP Annual Report, 1976
B. Rubin 13 Sep. 1976 33 p refs
(Contract W-7405-eng-48)
(UCRL-50029-76) Avail: NTIS HC A03/MF A01

The principal mission of the Energy and Resource Planning Group is to identify and evaluate the potential benefits of new energy technologies for the nation. The Stanford Research Institute Energy Model was used to help determine the effects of specific new energy technologies, and because the synthetic fuels produced by some of these new technologies will compete directly with domestic and imported oil and gas, the world crude oil supply and the projected costs of synthetic fuels were studied. The study on world oil supply indicates the possibility of a temporary price break in the early 1980s due to a rapid rise in free-world oil production, a currently constrained demand, and large expenditures by oil-exporting countries. Projected costs of synthetic liquid fuels were calculated on an equivalent accounting basis, at both production and delivery-pump levels. A number of modifications and additions were made to the SRI model for the studies. ERA

N77-25635# Illinois Univ., Urbana. Center for Advanced Computation.
ENERGY ANALYSIS HANDBOOK. CAC DOCUMENT 214
C. W. Bullard, P. S. Penner, and D. A. Pilati Oct. 1976 71 p refs
(Contract EY-76-S-02-2865)
(COO-2865-1; CAC-214) Avail: NTIS HC A04/MF A01

Methods are presented for calculating the energy required, directly and indirectly, to produce all types of goods and services. Procedures for combining process analysis with input-output analysis are described. This enables the analyst to focus data acquisition cost effectively, and to achieve a specified degree of accuracy in the results. The report presents sample calculations and provides the tables and charts needed to perform most energy cost calculations, including the cost of systems for producing or conserving energy. ERA

N77-25636# Kansas State Univ., Manhattan.
PERSPECTIVES IN ENERGY: 1976
J. K. Shultis 2 Aug. 1976 429 p refs
(CES-17) Avail: NTIS HC A19/MF A01

A compilation of seventeen lectures based on presentations from summer workshops held at Kansas State University is given. Information is covered on the current status of the energy situation to alternate energy options. ERA

N77-25637# AiResearch Mfg. Co., Phoenix, Ariz.
NATURAL FREQUENCY ANALYSIS OF THE BIPS
S. Yang 8 Apr. 1976 11 p
(Contract EY-76-C-03-1123)
(TID-27254) Avail: NTIS HC A02/MF A01

A dynamic model was set up to determine the fundamental frequencies of the BIPS. The model consists of a radiator which supports four discrete masses by means of interface structures. Various materials and several different sizes of interface structures were used in the analysis. The fundamental frequencies vary from 38 cps to 227 cps dependent upon the material and the size of interface structure. The built-in strength of all the interface structures is in excess of the 25 g's limit loading criteria. ERA

N77-25638# Sandia Labs., Albuquerque, N. Mex.
MAGMA ENERGY RESEARCH PROJECT, VOLUME 2, NO. 2
J. Colp, ed., J. A. Mogford, ed., and L. S. Marcrum Aug. 1976 19 p Sponsored by ERDA
(SAND-76-0264-Vol-2-No-2) Avail: NTIS HC A02/MF A01

The technological feasibility of extracting energy directly from deeply buried circulating magma sources is investigated. The project embodies the concept of a fully closed heat-exchange system inserted directly into a magma source to allow heat energy to be brought to the surface with minimal environmental impact. Accomplishments are briefly discussed for the four components of the project: source location and definition, source tapping, magma characterization and materials compatibility, and energy extraction studies. Author (ERA)

N77-25639# Los Alamos Scientific Lab., N. Mex.
LASL HOT DRY ROCK GEOTHERMAL PROJECT Progress Report, 1 Jul. 1975 - 30 Jun. 1976
A. G. Blair, comp., J. W. Tester, comp., and J. J. Mortensen, comp. Oct. 1976 238 p refs
(Contract W-7405-eng-36)
(LA-6525-PR) Avail: NTIS HC A11/MF A01

Successful drilling into hard crystalline rock was accomplished to depths of about 3 km. Hydraulic fractures in the crystalline rock with radii as large as 150 m were produced. At least 90 to 95 percent of water injected into fractured regions was recovered. A connection was established between two deep boreholes through a fractured region of hot granite for the first time. Instruments were developed to operate for several hours under the downhole conditions. The compressional and shear components of seismic signals produced by fracture extension and inflation were detected downholes. Acoustic ranging generally identified the relative positions of two boreholes at several depths. Self-potential and induced potential techniques determined vertical fracture lengths at the borehole. Pressure-flow and fluid residence time distribution studies have measured properties of the downhole system. Core sample studies provided physical and chemical data. Techniques were developed to examine reservoir performance. A geothermal power production model was formulated. Author (ERA)

N77-25640# Lockheed Missiles and Space Co., Palo Alto, Calif.
DEVELOPMENT OF PLASTIC HONEYCOMB FLAT-PLATE SOLAR COLLECTORS
K. N. Marshall, R. K. Wedel, and R. E. Dammann Apr. 1976 188 p refs
(Contract E(04-3)-1081)
(SAN-1081-76/1; LMSC-D462879) Avail: NTIS HC A09/MF A01

An analytical and experimental program was conducted to develop high performance flat plate solar collectors for use in the temperature range of 355 to 395 K using thin-film transparent plastic honeycomb. Thermal analyses showed that the efficiencies of properly designed plastic honeycomb covered collectors were substantially higher than those of comparable non-honeycomb systems. Candidate plastics were selected, and hexagonal shaped honeycombs were fabricated using Lexan, Mylar, Tedlar, and Kapton. Various honeycomb aspect ratios (L/D) between 1 and 10 were studied to determine the optimum. Full scale honeycomb collectors were constructed and tested under ambient weather conditions to determine actual performance and confirm analytical predictions. ERA

N77-25641# California Univ., Berkeley. Lawrence Berkeley Lab.
ASSESSMENT OF THE SOCIO-ECONOMIC AND ENVIRONMENTAL ASPECTS OF THE CENTRAL RECEIVER POWER PLANTS
M. Davidson, D. Grether, and M. Horowitz Aug. 1976 8 p refs Presented at Intern. Solar Energy Soc. Meeting, Winnipeg, Canada, 16-20 Aug. 1976
(Contract W-7405-eng-48)
(LBL-5291; Conf-760842-8) Avail: NTIS HC A02/MF A01

There are several aspects of the central receiver concept of an environmental or ecological nature which are discussed. A severe, direct environmental implication of this technology is destruction of the local ecosystem at and near plant sites. Another significant problem is the water necessary for plant cooling and construction in arid locales. The power plants could modify local and regional climate, but this subject is complicated by many factors, and no credible model was as yet developed to analyze it. Material requirements for these plants, at a level of construction of 8 gWe per year, would appear to have only minor effects on the economy. ERA

N77-25642# California Univ., Berkeley. Lawrence Berkeley Lab.
PERFORMANCE OF AN AIR-COOLED AMMONIA-WATER ABSORPTION AIR CONDITIONER AT LOW GENERATOR TEMPERATURES
K. Dao, M. Simmons, R. Wolgast, and M. Wahlig Aug. 1976 9 p Presented at Intern. Solar Energy Soc. Meeting, Winnipeg, Canada, 16-20 Aug. 1976
(Contract W-7405-eng-48)
(LBL-5224; Conf-760842-7) Avail: NTIS HC A02/MF A01

An ammonia water absorption air conditioning system was tested to investigate the stability of operation near the cut-off conditions. Circulation ratios were from 8 to 30. Relations for the estimation of the coefficient of performance and for the prediction of operating temperatures were derived and verified experimentally. Possible operating conditions for an air cooled ammonia water air conditioning system were concluded. ERA

N77-25643# Maryland Univ., College Park. Dept. of Mechanical Engineering.
PROCEEDINGS OF THE SOLAR INDUSTRIAL PROCESS HEAT WORKSHOP
William R. Cherry (ERDA, Washington, D.C.), William W. Auer (ERDA, Washington, D.C.), Redfield W. Allen, and Davinder K. Anand Aug. 1976 83 p Proc. held at College Park, Md., 28-29 Jun. 1976
(Contract E(49-18)-2324)
(CONF-760655) Avail: NTIS HC A05/MF A01

Demand information obtained from energy intensive industries in the Southwest has been utilized to size solar total energy systems, individual process heat, and electrical systems. Distributed and central receiver collection systems were investigated. For the example cited, although the central receiver is more efficient, preliminary costing exercises indicate that a distributed system is more economical. ERA

N77-25644# Sandia Corp., Albuquerque, N. Mex.
DESIGN OPTIMIZATION OF SILICON SOLAR CELLS FOR CONCENTRATED-SUNLIGHT, HIGH-TEMPERATURE APPLICATIONS
J. G. Fossum 1976 5 p refs Presented at Intern. Electron Devices Meeting, Washington, D. C., 6 Dec. 1976
(Contract E(29-1)-789)
(SAND-76-9068; Conf-761207) Avail: NTIS HC A02/MF A01

The utilization of a proven device analysis computer code in the design optimization of silicon solar cells for use in concentrated-sunlight, high-temperature environments is described. The code provides detailed one-dimensional numerical solutions of carrier transport in the cell and greatly facilitates the identification of design modifications to effect performance improvement. In conjunction with these simulations, two-dimensional spreading resistance calculations are used to optimize the top electrode pattern of the cell. Solar cells were fabricated and experimentally characterized to confirm theoretical predictions. ERA

N77-25645# AiResearch Mfg. Co., Phoenix, Ariz.
BIPS-GDS MISCELLANEOUS, DESIGN NOTES
15 Jun. 1976 78 p refs
(Contract EY-76-C-03-1123)
(TID-27260) Avail: NTIS HC A05/MF A01

A compendium of miscellaneous documents, memos, and progress report extracts for the Brayton Isotope Power System Ground Demonstration System preliminary design review is presented. The document is furnished to aid the customer in evaluating the progress of the ERDA BIPS GDS design. ERA

N77-25646# AiResearch Mfg. Co., Phoenix, Ariz.
BIPS-FS PRELIMINARY DESIGN, MISCELLANEOUS NOTES
15 Jun. 1976 68 p refs
(Contract EY-76-C-03-1123)
(TID-27261) Avail: NTIS HC A04/MF A01

A compendium of flight system preliminary design internal memos and progress report extracts for the Brayton Isotope Power System Preliminary Design Review is presented. The purpose is to bring together those published items which relate only to the preliminary design of the flight system. ERA

N77-25647# Kaman Sciences Corp., Colorado Springs, Colo.
UNITED STATES SPECIAL FORMAT REPORT: REPORT OF THE PHOENIX CORPORATION, CITY OF COLORADO SPRINGS SOLAR HEATING PROJECT
D. M. Jardine Jun. 1976 72 p refs
(SE-4578-76/1; WA/4578-76/1) Avail: NTIS HC A04/MF A01

The development of a solar assisted heat pump system and its operating characteristics is covered. The thermal energy storage subsystem is of prime importance to the operation of the system. The performance of the underground uninsulated steel tank containing water and using the ground as an additional thermal energy storage medium to act as a heat source and heat sink for the system is reported. The type and performance of the heat pump used is covered. The use of commercially available heat transfer fluid in the collector and heat pump evaporator thermal energy transfer system to eliminate corrosion, electrolysis, boiling, and freezing within the system is presented. The system economic analysis covers the cost of backup and system operating energy as a large economic factor that must be recognized.
Author (ERA)

N77-25648# Arizona State Univ., Tempe. Coll. of Engineering and Applied Sciences.
ENERGY IN PERSPECTIVE: AN ORIENTATION CONFERENCE FOR EDUCATORS
John W. McKlveen, ed. 1976 422 p refs Proc. held at Tempe, Ariz., 7-11 Jun. 1976
(Contract E(11-1)-2937)
(CONF-760677) Avail: NTIS HC A18/MF A01

Papers on all aspects of energy were presented at the conference by experts from throughout the United States. The

tours to energy installations conducted during the conference and demonstration related to energy are cited. ERA

N77-25649# AiResearch Mfg. Co., Phoenix, Ariz.
TRANSIENT ANALYSIS BRAYTON ISOTOPE POWER SYSTEM, SUPPLEMENT 1
2 Apr. 1976 112 p
(Contract EY-76-C-03-1123)
(TID-27253) Avail: NTIS HC A06/MF A01

A simulation of the most rapid start-up thermal transient which would be encountered in the BIPS operation was studied. In order to obtain the data, several computer cases were run. A summary of the computer runs made is presented in tabular form. ERA

N77-25650# AiResearch Mfg. Co., Phoenix, Ariz.
BRAYTON ISOTOPE POWER SYSTEM, DESIGN INTEGRITY CHECKLIST (BIPS-DIC)
L. G. Miller 10 Jun. 1976 13 p
(Contract EY-76-C-03-1123)
(TID-27259) Avail: NTIS HC A02/MF A01

The Brayton Isotope Power System-Design Integrity Checklist (BIPS-DIC) has been revised and is presented. Additional entries have been added that reference failure modes determined to rank highest in criticality ranking. The checklist will be updated periodically. ERA

N77-25651# AiResearch Mfg. Co., Phoenix, Ariz.
BRAYTON ISOTOPE POWER SYSTEM (BIPS), PHASE 1 Annual Technical Report No. 1
27 Oct. 1976 106 p refs
(Contract EY-76-C-03-1123)
(SAN-1123-76/1) Avail: NTIS HC A06/MF A01

Phase 1 of the three-phase Brayton Isotope Power System (BIPS) program is the conceptual design of the flight system, the design, development, and testing of a prototype Ground Demonstration System (GDS). ERA

N77-25652# AiResearch Mfg. Co., Phoenix, Ariz.
LOOP CONTAINMENT (JOINT INTEGRITY) ASSESSMENT BRAYTON ISOTOPE POWER SYSTEM FLIGHT SYSTEM
1 Jun. 1976 25 p refs
(Contract EY-76-C-03-1123)
(TID-27258) Avail: NTIS HC A02/MF A01

The reliability of the loop containment (joint integrity) is evaluated. The conceptual flight system as presently configured is depicted. A brief description of the flight system is given. ERA

N77-25653# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
OPTICAL STUDY OF FIXED SPHERICAL SOLAR COLLECTORS
B. Authier 1976 20 p refs In FRENCH; ENGLISH summary Submitted for publication
(LAS-PRC-76-01) Avail: NTIS HC A02/MF A01

A geometrical optics study is presented which permits a graphical representation of the radiation incident along the sagital line. It is shown that the addition of the mobile mirror element (viser) considerably increases the intercepted radiation in tropical regions. ESA

N77-25654# Missouri Univ., Columbia. Dept. of Electrical Engineering.
DEVELOPMENT OF A NEW SILICON SCHOTTKY PHOTOVOLTAIC ENERGY CONVERTER Final Report, 15 Jan. 1975 - 30 Jun. 1976
E. J. Charlson Aug. 1976 51 p refs
(Contract NSF ENG-74-02918)
(PB-262491/4; UMC-SSL-1) Avail: NTIS HC A04/MF A01 CSCL 10B

An Al/P-type silicon MOS solar cell was investigated. The structure includes a controlled thickness interfacial oxide layer between the Al and the silicon. Electrical data from a large number of different fabrication techniques are given. A detector mode current multiplication was discovered and analyzed. Polycrystalline substrates were found to yield good solar cells with approximately one-half the conversion efficiency of single crystal cells. Included are TEM micrographs of the thin film and semiconductor surfaces. Quantum efficiency measurements are also included. GRA

N77-25655# Federal Energy Administration, Washington, D. C. Office of Energy Resource Development.
TRENDS IN POWER PLANT CAPACITY AND UTILIZATION. INVENTORY OF POWER PLANTS IN THE UNITED STATES
Dec. 1976 325 p
(PB-264451/6; FEA/G-77/100) Avail: NTIS HC A14/MF A01 CSCL 10B

An inventory of existing and projected electricity generating power plants in the U.S. is presented. The data are assembled by state and standard federal region. It shows plant location by county, company owner, unit name, nameplate rating, type of unit, primary and alternate fuels where known, status (existing or projected), date completed or estimated to be complete, source of information, and last update of information. The projected plant section provides additional information on status of environmental impact statements, prime component delivery, permit problems, construction start date, and scheduled completion date. GRA

N77-25656# Department of Environment, Housing and Community Development, Canberra (Australia).
SOLAR WATER HEATING IN DWELLINGS. SURVEY OF SELECTED PROSPECTIVE USERS IN SYDNEY
P. R. Smith Jan. 1977 34 p
(PB-264151/2) Avail: NTIS HC A03/MF A01 CSCL 13A

Domestic solar hot water systems have been used fairly extensively in Western Australia and the Northern Territory, and more recently in South Australia. However they are little used in Melbourne and Sydney, which might be considered as large potential markets. A survey was undertaken in Sydney to assess the knowledge and views of potential users in relation to solar heating units. GRA

N77-25657# National Bureau of Standards, Washington, D. C. Building Environment Div.
AN INFRARED TECHNIQUE FOR HEAT-LOSS MEASUREMENT
D. M. Burch, T. Kusuda, and D. G. Blum Apr. 1977 55 p refs Sponsored by FEA
(PB-264259/3; NBS-TN-933) Avail: NTIS HC A04/MF A01 CSCL 13A

A device called a heat-flow reference pad was developed that makes it possible to estimate quantitatively the heat-loss rate at the surface of a building without the need for a conventional heat-flow meter to be mounted on the surface. Technical considerations for the design of a heat-flow reference pad are presented. The infrared measurement technique predicted heat-loss rates in the laboratory and field within approximately 12 percent. GRA

N77-25658# National Bureau of Standards, Washington, D. C. Building Economics Section.
EQUIPMENT MAINTENANCE FOR ENERGY CONSERVATION Final Report
Joel Levy Feb. 1977 55 p refs Sponsored in part by FEA
(PB-264297/3; NBSIR-77-1210) Avail: NTIS HC A04/MF A01 CSCL 10A

A general model of equipment performance as a function of maintenance is developed that permits quantification of the optimal level of maintenance in terms of performance attainment and relative factor costs. The model formulation is that of a finite state, finite action Markovian decision process. The model will help maintenance engineers, building managers, and/or others responsible for making decisions concerning maintenance policies in selecting economically efficient levels of maintenance for elements of building service equipment. GRA

N77-25659# Environmental Protection Agency, Washington, D. C. Office of Monitoring Systems.
PROCEEDINGS OF THE 2D CONFERENCE ON ENVIRONMENTAL QUALITY SENSORS
Dec. 1976 779 p Conf. held at Las Vegas, Nevada, 10-11 Oct. 1973
(PB-264183/5; EPA-600/9-76-031) Avail: NTIS

HC A99/MF A01 CSCL 14B

The Second Conference on Environmental Quality Sensors was held at the U. S. Environmental Protection Agency's National Environmental Research Center, Las Vegas, Nevada, on October 10 and 11, 1973. The papers presented covered such topics as: aircraft, satellite, and land based remote sensing systems for monitoring and/or identifying pollutants in the air, in water, and on land; in situ monitoring systems; remote sensing techniques for land use mapping; environmental impact assessment; water surface temperature determination; and oil and hazardous material spills identification. Environmental monitoring requirements of the EPA regions were also addressed. GRA

N77-25660# Army Construction Engineering Research Lab., Champaign, Ill.

PREDICTING THE PERFORMANCE OF SOLAR ENERGY SYSTEMS Final Report

D. C. Hittle, G. N. Walton, D. F. Holshouser, and D. J. Leverenz Jan. 1977 46 p refs

(DA Proj. 4A7-63734-DT-08)

(AD-A035608; CERL-IR-E-98) Avail: NTIS HC A03/MF A01 CSCL 10/1

This report presents a method for making an energy and life cycle cost analysis of solar energy systems. A graphical method is presented for predicting the performance of solar domestic hot water systems, solar heating systems, and solar heating and cooling systems. Methods for selecting the optimum collector area based on life cycle cost and for systematically making detailed design calculations using the building loads analysis and system thermodynamics blast computer simulation program are also presented. Practical considerations for solar system designs are discussed. The methods presented provide the required accuracy for both initial evaluations and final design calculations. Examples are provided throughout the test to aid in using the methods described. GRA

N77-25661# Logistics Management Inst., Washington, D. C.

PROJECT INDEPENDENCE EVALUATION SYSTEM (PIES) DOCUMENTATION. VOLUME 1: THE INTEGRATING MODEL OF THE PROJECT INDEPENDENCE EVALUATION SYSTEM

Sep. 1976 438 p

(Contract FEA-CR-03-60501-00)

(PB-263020/0; FEA/N-76/411-Vol-1) Avail: NTIS HC A19/MF A01 CSCL 10A

The Project Independence Evaluation System (PIES) is a complex computer model developed by the FEA for its use in energy policy analyses. PIES represents the energy economy of the nation on an average day in selected target years-1980, 1985, or 1990. By varying the assumptions and data, the model is used to simulate the effect of differing energy policies or trends. The entire model is described in a general fashion as well as the specific implementation of different sectors of the supply portion of the model. The supply portion of the model contains fossil fuel supply activities, fuel conversion activities and transportation activities. GRA

N77-25662# Maine Univ., Orono. Dept. of Electrical Engineering.

TERNARY COMPOUND THIN FILM SOLAR CELLS Final Report, 1 Jun. - 31 Aug. 1976

L. L. Kazmerski Oct. 1976 58 p refs

(Grant NSF AER-75-19576)

(PB-262536/6; NSF/RA-760351) Avail: NTIS HC A04/MF A01 CSCL 10B

The materials under investigation are CuInS2, CuInSe2 and CuInTe2--and, both homojunctions and heterojunctions involving these chalcopyrite materials are under consideration. The primary development during the final quarter was concerned with the CdS/CuInSe2 heterojunction. A 'best' efficiency of 6.2% was achieved for this device. An Auger electron spectroscopy depth-compositional analysis of this device has indicated that the diffusion of Cd from the CdS layer into the CuInSe2 film is a possible degradation problem for this solar cell. The grain boundary diffusion coefficient of Cd (from CdS) into CuInSe2 was determined using the Hall-Morabito formalism. The production of CuInS2 homojunction and CuInS2/CdS heterojunction solar cells is also reported. GRA

N77-25663# RCA Labs., Princeton, N. J.

EPITAXIAL SILICON TECHNOLOGY FOR LOW-COST SOLAR CELLS Final Report, 1 May 1975 - 30 Apr. 1976

H. Kressel, R. DAiello, E. R Levin, P. M. Raccah (Yeshiva Univ.), F. H. Pollack (Yeshiva Univ.), S. H. McFarlane, and P. Robinson May 1976 97 p refs

(Grant NSF AER-74-15532)

(PB-262396/5; PRRL-76-CR-25; NSF/RANN/SE/AER74-15532/PR-76; NSF/RA-760355) Avail: NTIS HC A05/MF A01 CSCL 10B

A method is demonstrated for improving solar cell devices by using thin epitaxial layers deposited on polycrystalline silicon ribbon. The program encompasses analytical studies aimed at relating the defects to device performance, and the fabrication of solar cells on a comparative basis (diffusion vs. epitaxial growth on crystals of similar quality) to establish the improvement which is obtained. The program demonstrates substantially improved performance with approximately 50 micrometer-thick epitaxial layers compared with those made by direct diffusion. The difference in performance is analyzed in detail, to yield significant new insight into the factors controlling the solar cell efficiency when such devices are fabricated in large-grained polycrystalline silicon ribbon. GRA

N77-25664# Oklahoma State Univ., Stillwater.

A POOLED CROSS-SECTIONAL TIME-SERIES ANALYSIS OF THE DEMAND FOR INTERNATIONAL TELECOMMUNICATIONS SERVICE

Gerald M. Lage and John D. Rea Jan. 1976 44 p refs

(Contract TP-6AC008)

(PB-262537/4; OTP-77-01) Avail: NTIS HC A03/MF A01 CSCL 05C

The results are presented of a pooled cross-sectional time-series analysis of the demand for international telephone, telegraph, and telex services. The analysis of this report is based upon that presented in an earlier report entitled 'A Time Series Analysis of the Demand for Telecommunications Services from the United States to the United Kingdom.' In the earlier report, estimation of the demand for each service was on a route-by-route basis. In this report the demand equations are estimated by combining the data for 37 major routes for the years 1964-1973. GRA

N77-25665# KVB Engineering, Inc., Tustin, Calif.

ASSESSMENT OF THE POTENTIAL FOR ENERGY CONSERVATION THROUGH IMPROVED INDUSTRIAL BOILER EFFICIENCY, VOLUME 1 Final Report

Jan. 1977 276 p refs

(Contract FEA-C-04-50085-00)

(PB-262576/2; FEA/D-77/025) Avail: NTIS HC A13/MF A01 CSCL 13A

Boiler efficiency in the use of gas, oil, and coal was studied. Cost effective equipment additions and improvements, including heat-recovery devices and combustion controls are discussed. Maximum attainable efficiencies using current technologies without consideration for cost are also reported. GRA

N77-25666# Little (Arthur D.), Inc., Cambridge, Mass.

A LOCATION MATRIX PLAN FOR THE RESIDENTIAL SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM. VOLUME 2: PROCEDURES AND APPENDICES

May 1976 292 p refs

(Contract HUD-H-2350)

(PB-262646/3; ADL-C-785384-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 13A

A detailed plan is provided for the experimental portion of the residential solar heating and cooling demonstration program to be conducted by HUD. The plan is designed to permit HUD, in a structured series of demonstration projects, to investigate the effect of building codes, zoning regulations, tax procedures, and other administrative activities on the practical use of solar energy for heating and cooling buildings and heating domestic water in various climate and geographic areas. Volume II explains the methodology used in developing the recommendations, the procedures followed in the selection of site locations, and describes some of the constraints identified in the study. GRA

N77-25667# ICF, Inc., Washington, D.C.
ELECTRIC UTILITY COAL CONSUMPTION AND GENERATION TRENDS, 1976-1985
Nov. 1976 49 p refs
(Contract FEA-P-05-76-2660-0)
(PB-262483/1; FEA/G-76/428) Avail: NTIS HC A03/MF A01 CSCL 10B

In 1975, electric utilities accounted for roughly 400 million tons or 73% of total domestic coal consumption, a dramatic increase of 45% since 1955. For these and other reasons, well founded estimates of future coal consumption for electricity generation are becoming increasingly important to a number of interested parties including utility planners, coal producers, government policy makers and environmentalists. The annual reports of the nine Regional Electric Reliability Councils to the Federal Power Commission on the status of their respective Bulk Power Supply Programs provide much of the basic data necessary for constructing such a detailed utility coal consumption forecast. This study updates last year's effort based on the regional councils' April 1, 1976 submissions. Included are a reexamination of the future trends in generation requirements and capacities implicit in the councils' data and new forecasts of utility coal consumption under alternative electricity demand growth assumptions. GRA

N77-25668# Federal Energy Administration, Washington, D. C. Office of the Administrator.
FEDERAL ENERGY INFORMATION GATHERING ACTIVITIES: A REPORT TO THE PRESIDENT OF THE UNITED STATES, AND THE ENERGY RESOURCES COUNCIL
Dec. 1976 49 p
(PB-262844/4; FEA/T-77/033) Avail: NTIS HC A03/MF A01 CSCL 10A

Federal Energy Administration activities concerning energy information is reported. The present system of Federal energy data gathering activities is described, and recommendations with respect to the coordination of energy information activities within the Federal Government are provided. GRA

N77-25669# Bureau of Mines, Pittsburgh, Pa. Eastern Field Operation Center.
PROJECTS TO EXPAND FUEL SOURCES IN EASTERN STATES: SURVEY OF PLANNED OR PROPOSED COAL MINES, COAL AND NONCOAL CONVERSION PLANTS, ELECTRIC GENERATING PLANTS, OIL REFINERIES, URANIUM ENRICHMENT FACILITIES, AND RELATED INFRASTRUCTURE, IN STATES EAST OF THE MISSISSIPPI RIVER (AS OF JUNE 1976)
Dec. 1976 121 p refs
(PB-262361/9; BM-IC-8725) Avail: NTIS HC A06/MF A01 CSCL 10A

Tables listing the name, location, and other pertinent data concerning future fuel related projects are presented. The tables include information on projects involving the proposed or planned development of fuel resources, as well as the development of storage, transportation, and conversion facilities. The 26 states east of the Mississippi River are included. Of the total 592 projects for which information is provided, 492 concern coal mines and electric generating plants. GRA

N77-25670# Booz-Allen and Hamilton, Inc., Washington, D. C.
THE EFFECTIVENESS OF SOLAR ENERGY INCENTIVES AT THE STATE AND LOCAL LEVEL
Mar. 1976 95 p refs
(Contract FEA-CO-05-50272-00)
(PB-263371/7; FEA/G-77/046) Avail: NTIS HC A05/MF A01 CSCL 13A

The Federal Energy Administration (FEA) is currently developing policies and programs to accelerate the utilization and widespread commercialization of solar energy technologies. Existing, proposed and possible state and local actions to encourage or stimulate the use of solar energy heating and cooling systems are reviewed. The state and local issues surrounding widespread solar energy development, and areas for assessment and evaluation, both in the design of state and local incentive programs and in the development of Federal support of those efforts, are emphasized. GRA

N77-25671# Science Applications, Inc., McLean, Va. Fluid Mechanics Div.
TWO-DIMENSIONAL NUMERICAL MODEL OF THE NEAR-FIELD FLOW FOR AN OCEAN THERMAL POWER PLANT. PART 2: SIMULATION OF THE LOCKHEED BASELINE DESIGN Final Report, Apr. - Nov. 1976
Glyn O. Roberts, Steve A. Piacsek (NRL, Washington, D. C.), and Juri Toomre (NRL, Washington, D. C.) Dec. 1976 54 p refs
(Contracts N00014-76-C-0610; E(49-26)-1005)
(AD-A035462; SAI-76-625-WA; NRL-GFD/OTEC-6-76) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report describes a computation of the stratified turbulent flow-field near the Lockheed baseline Ocean Thermal Power Plant OTPP design, with zero ambient current. The calculations uses a two-dimensional near-field computer code NRFLO2, and approximates the flow associated with one of the four modules by assuming a rectangular domain of depth 500 ft, with horizontal slots at one end to represent the warm inflow and the two outflows. Flow is assumed to be statistically uniform across the width of this domain. Widths of 50 ft, 100 ft, 200 ft, and 400 ft are separately assumed the 100-ft and 200-ft computations essentially bracket the results for the prototype flow. Numerical results for the average warm inflow temperatures, in the 4 cases, are 75.7 F, 77.2 F, 77.9 F, and 78.6 F. This is with a surface temperature of 80 F. The warm outflow is defined to be 3 F cooler the cold outflow temperature is set to 45 F. Numerical results for the OTPP-generated turbulent diffusivity indicate that it is effectively confined to the neighborhood of the plant. Its value is very small outside such a neighborhood. GRA

N77-25672# Coast Guard Research and Development Center, Groton, Conn.
LABORATORY EVALUATION OF SOLAR POWER UNITS FOR MARINE AIDS TO NAVIGATION Interim Report
J. S. Ryba and David A. Naus Jun. 1976 80 p ref
(AD-A034987; CGR/DC-5/76; USCG-D-106-76) Avail: NTIS HC A05/MF A01 CSCL 10/2

This report describes the Coast Guard evaluation of solar energy as a power source for lighted aids to navigation. Fifty-three solar powered aids, on test in a natural environment at Groton, Connecticut, have been continuously monitored for two years. Solar arrays from two manufacturers were tested with neither being wholly satisfactory. One had major quality control problems while the other suffered from inadequate sealing. Three types of lead-acid batteries used for energy storage have all been satisfactory to date. The test has indicated the advantages of voltage regulation in reducing water use in batteries, but has not proved that regulation is in fact required for long battery life. The insolation measured has shown excellent agreement with that predicted using the averages from a surrogate area. Almost all of the original estimates that were made to predict system performance (battery capacity vs. time of year) proved to be very conservative and most of the systems performed better than expected. Author (GRA)

N77-25673# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Atomic and Molecular Science.
REPORT OF THE SUBCOMMITTEE ON ENERGY-RELATED ATOMIC AND MOLECULAR SCIENCE Report, Feb. - Oct. 1975
Charles K. Reed Sep. 1976 85 p refs
(PB-264052/2; NSF/ERG-75-48) Avail: NTIS HC A05/MF A01 CSCL 10A

The use of fundamental atomic and molecular physics in directed energy-related areas of research, including: fusion research, fission research, fossil fuel research, laser development, and gaseous electronics are explored. GRA

N77-25674# Natural Resources Defense Council, Inc., Palo Alto, Calif.
CHOOSING AN ELECTRICAL ENERGY FUTURE FOR THE PACIFIC NORTHWEST: AN ALTERNATIVE SCENARIO Final Report
Roger Beers and Terry R. Lash 31 Jan. 1977 187 p refs
(PB-264048/0) Avail: NTIS HC A09/MF A01 CSCL 10A

The scenario is based primarily upon an analysis of each major end use of electricity in all sectors of the Pacific Northwest. On this basis, it forecasts the improvements in the efficiency of energy use, which are likely without any change in current policies or programs, together with the greater efficiencies which could be achieved by new initiatives. GRA

N77-25675# Army Electronics Labs., Fort Monmouth, N. J.
METHANOL-AIR BATTERIES
John Perry, Jr. Jan. 1977 32 p refs
(AD-A035942; ECOM-4457) Avail: NTIS HC A03/MF A01 CSCL 10/2

The methanol-air battery shows promise of meeting the operational requirements of low power equipment, such as sensors, mines, and similar equipments. While primarily designed to satisfy low level output requirements, the system is capable of supporting transient peak loads on a cyclical basis. Cells charged with 120 ml of anolyte, consisting of 6 M methanol in 11 M KOH, have operated for 2,230 hours under cyclic load drains of 50 MA for 13 minutes and 2 A for 1 second. One cell operated for more than 8,000 hours with periodic refilling of fresh anolyte, demonstrating the long serviceable life of the electrode components. Fuel utilization efficiencies as high as 84 % have been obtained from cells charged with an anolyte solution of methanol in potassium hydroxide. Single cells charged with a fuel mixture of methanol and methyl formate in 5 M KOH operated satisfactorily under load at temperatures down to -40 C, with only a 30% decrease in voltage during the 2 A period of the cycle. GRA

N77-25676# ESB, Inc., Yardley, Pa. ESB Technology Center.
PRODUCTION AND ENGINEERING METHODS FOR CARB-TEK (TRADE NAME) BATTERIES IN FORK LIFT TRUCKS Interim Report, Mar. 1975 - Mar. 1976
James C. Schaefer Mar. 1976 59 p refs
(Contract DAAK02-75-C-0035)
(AD-A035983; MERADCOM-CR-0035-2) Avail: NTIS HC A04/MF A01 CSCL 10/3

The purpose of this program is to establish the manufacturing techniques for production of improved fork lift truck batteries. This portion involves the manufacturing technology of the Carb-Tek molten salt Li/Cl system, constructing cells on a pilot line, optimizing process steps, establishing quality control procedures, and engineering appropriate changes. Cell Assembly is performed in a controlled argon atmosphere. Average capacity of pilot line design 6 cells was 8 AH with a maximum value of 10.6. Maximum value of cathodes as formed was 12/75 AH. A new economical, anode alloy preparation is reported. System maintenance problems were greatly reduced by improved leak detection. GRA

N77-25677# Battelle Columbus Labs., Ohio. Tactical Technology Center.
A SUMMARY OF THE DARPA ENERGY AND MATERIALS SHORTAGES PROGRAMS, FISCAL YEARS 1972-1976 Final Report
James O. Frankosky, Charles Ravitsky, and Frank Milner Dec. 1976 199 p refs
(Contract DAAH01-72-C-0982; ARPA Order 2209)
(AD-A036021; A-4825) Avail: NTIS HC A09/MF A01 CSCL 15/5

This report presents a summary of the several research efforts by DARPA during fiscal years 1972-1976 for investigations in the fields of energy and materials shortages. It is essentially a summary program completion report. It presents an overview, broken down into four major areas energy availability and national security considerations, alternate sources of energy at military installations, energy alternatives in propulsion, and potential materials shortages and their implications for national security. The overview is supported by the appendices, each addressing a separate area of investigation. Author (GRA)

N77-25678# Army Engineer Topographic Labs., Fort Belvoir, Va.
CHARGING EQUIPMENT, MOBILE (CEM) Final Report, Oct. 1972 - Nov. 1974
Richard Basehore and Steve Nagy Jun. 1976 36 p refs
(DA Proj. 1J6-64716-D-578)
(AD-A036071; ETL-0089) Avail: NTIS HC A03/MF A01 CSCL 10/3

This report covers the design, fabrication, test, and operation of the Charging Equipment, Mobile (CEM) which provides a mobile battery charging capability to field units. The design and fabrication was performed in-house at the U.S. Army Engineering Topographic Laboratories to support the Long Range Position-determining System (LRPDS). The CEM has been used specifically to recharge BB-451/U, silver-zinc batteries used with LRPDS backpackable ground units. However, the dialable voltage cutoff in the battery charger will permit recharge of silver-cadmium and lead-acid batteries, among others. The equipment was used extensively in the field tests of the LRPDS for charging BB-451/U batteries at 2.25 amperes with a cutoff at 32 volts. Although activation of the BB-451/U batteries is a slow and painstaking operation, nine batteries were easily and reliably recharged at one time. Besides the operational tests, a safety evaluation and a road test were made by the U.S. Army Test and Evaluation Command. No unusual hazards were found, and there was no evidence of physical damage after runs over the Munson Road at the Aberdeen Proving Ground. Author (GRA)

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-25679 British Library Lending Div., Boston Spa (England).
EFFECT OF VEGETATION OF ATMOSPHERIC SULPHUR DIOXIDE
A. Bytnerowicz and B. Molski Jan. 1977 22 p refs Transl. into ENGLISH from Wiadomosci Botaniczant (Kracow), v. 18, no. 3, 1974 p 169-182
(BLL-RTS-10504) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL Photocopy coupons

Aspects of the effect of sodium dioxide (SO2) on plants were discussed. One of the main aspects is the capacity of relatively resistant plants to absorb SO2 in considerable quantities and subsequently to convert it to sulphates accumulated in plant tissues. There also exists the possiblity of greatly reducing the SO2 content in the air by setting up at emission sources screens of plants capable of appreciable absorption of this gas. The other question discussed is the use of susceptible plants damaged in proportion to the SO2 dose, as pollution indicators. Author

N77-25680# Royal Netherlands Meteorological Inst., De Bilt.
APPLICATION OF THE RECOMMENDED NATIONAL AIR POLLUTION MODEL OF THE NETHERLANDS TO THE NATO COMMON DATA BASE FOR THE FRANKFURT AREA
F. T. M. Nieuwstadt and C. A. Engeldal 1976 17 p refs
(KNMI-WR-76-17) Avail: NTIS HC A02/MF A01

The air pollution model described was applied to the NATO/CCMS data base, and the annual averaged concentration was calculated. A distinction was made between the contributions due to area source emissions and those due to point source emissions. The results for the annual averaged concentration are presented in the form of isopleth maps and are also given for six specified receptor locations. The calculated concentrations are compared with preliminary results. Author (ESA)

N77-25681# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
ANALYSIS OF THE NLR AIRPORTS POLLUTION DISPERSION MODEL ON SENSITIVITY FOR METEOROLOGICAL PARAMETERS AND ON SOURCE MODELING
J. J. Tiggelaar 7 Dec. 1976 32 p refs
(NLR-TR-75014-U) Avail: NTIS HC A03/MF A01

It was found that the weather resolution of the model is satisfactory in view of the present standards of meteorological measurement. Atmospheric stability (Pasquill class) turned out to be the parameter that influences the pollution dispersion most, expecially through its influence on vertical dispersion rate. For long term prediction of pollution levels, where mean values of weather parameters are more accurately known, the meteorological modeling is most appropriate. To treat real airplanes, which

do not emit continuously (e. g. if above the inversion layer, emitted pollution does not reach the ground), the Gaussian plume was modified into a cut-off plume. Then modeling of the polluting airplanes by series of moving point sources, using the cut-off plume, was compared with modeling them by a line source representing their averaged emission. It was found that deviations are important only in close vicinity of taxi and flight tracks, e. g., on the airport itself. Thus for applications to the surroundings of airports, the line source modeling, present in the model, is adequate. Author (ESA)

N77-25682# Battelle Pacific Northwest Labs., Richland, Wash.
SO2 OXIDATION IN PLUMES: A REVIEW AND ASSESSMENT OF RELEVANT MECHANISTIC AND RATE STUDIES Final Report
A. Levy, D. R. Drewes, and J. M. Hales Sep. 1976 104 p refs
(Contract EPA-68-02-1982)
(PB-264206/4; EPA-450/3-76-022) Avail: NTIS HC A06/MF A01 CSCL 07D

The scientific literature pertaining to the oxidation of SO2 in power plant plumes is reviewed. Aqueous phase, homogeneous gas phase, and heterogeneous gas phase mechanisms are considered, as are actual plume studies. The reported rates vary over a wide range, which is not totally unexpected due to the highly complex nature of the oxidation process. The following general conclusions can be drawn: (1) recent plume studies, in general, indicate lower rates than earlier ones, and also suggest a coincidence between the reappearance of ozone in the plume and oxidation of SO2; (2) gas phase studies indicate homogeneous reaction of SO2 with OH radicals and heterogeneous reactions catalyzed by lead and iron to be perhaps the most significant processes; and (3) in the aqueous phase, the reaction is most effectively catalyzed by iron and manganese, and ammonia plays an important role in promoting the oxidation by maintaining a high pH. GRA

N77-25683# Southern Research Inst., Birmingham, Ala.
HP-65 PROGRAMMABLE POCKET CALCULATOR APPLIED TO AIR POLLUTION MEASUREMENT STUDIES: STATIONARY SOURCES User Handbook, Nov. 1975 - Oct. 1976
James W. Ragland and Kenneth M. Cushing Oct. 1976 124 p
(Contract EPA-68-02-2131)
(PB-264284/1; SORI-EAS-76-447; EPA-600/8-76-002) Avail: NTIS HC A06/MF A01 CSCL 13B

The handbook is intended for persons concerned with air pollution measurement studies of stationary industrial sources. It gives detailed descriptions of 22 different programs written specifically for the Hewlett Packard Model HP-65 card-programmable pocket calculator. For each program there are: a general description, formulas used in the problem solution, numerical examples, user instructions, and program listings. Author

N77-25684# Commerce Dept., Washington, D.C. Office of Environmental Affairs.
ENERGY REQUIREMENTS FOR AIR POLLUTION CONTROL IN THE PRIMARY ALUMINUM INDUSTRY Final Report, Sep. 1975 - Jan. 1977
Richard J. Herbst and Robert B. Grant Jan. 1977 96 p refs
(PB-264483/9) Avail: NTIS HC A05/MF A01 CSCL 13B

Environmental regulations and production processes in the primary aluminum industry which are most important in terms of the amounts of energy consumed for pollution control purposes are identified. The relationship between energy consumption and pollution control is quantified in a detailed and comprehensive manner which considers both direct (in-plant) and indirect (pre- and post-plant) effects. GRA

N77-25685# Battelle Pacific Northwest Labs., Richland, Wash.
MEASUREMENT OF DRY DEPOSITION OF FOSSIL FUEL PLANT POLLUTANTS Final Report, 24 Jun. 1974 - 24 Jun. 1976
J. G. Droppo, D. W. Glover, A. B. Abbey, C. W. Spicer, and J. Cooper Nov. 1976 135 p refs
(Contract EPA-68-02-1747)
(PB-264495/3; EPA-600/4-76-056) Avail: NTIS HC A07/MF A01 CSCL 13B

Dry removal of air pollutants from fossil fuel plants is considered from both a modeling and measurement viewpoint. Literature on dry deposition rates is summarized and the processes involved in dry deposition are discussed. The dry deposition of SO2, O3, NOx, and NO, as well as total sulfur and lead particles are considered. A prototype field data acquisition system was developed, assembled, and tested. Deposition velocities were computed for each field test. The sulfur dioxide profiles gave reasonable estimates of the dry deposition values, comparable to those in the literature. They varied from 0.10 to 2.38 cm/sec for the test runs. Values for the O3 deposition velocities were very small. The results for NO varied over a wide range, with the number of profiles measured in the test runs insufficient for reaching a definitive conclusion. GRA

N77-25686# APT, Inc., San Diego, Calif.
EFFECTS OF TEMPERATURE AND PRESSURE ON PARTICLE COLLECTION MECHANISMS: THEORETICAL REVIEW Final Report, Dec. 1975 - Sep. 1976
Seymour Calvert and Richard Parker Jan. 1977 96 p refs
(Contract EPA-68-02-2137)
(PB-264203/1; EPA-600/7-77-002) Avail: NTIS HC A05/MF A01 CSCL 13B

Equations and models used to predict particle behavior at normal conditions, with regard to their applicability at high temperatures and pressures are presented. Available experimental data, concluding that the data are inadequate to confirm the projections of aerosol mechanics at high temperatures and pressures are discussed. A few examples of the effects of high temperature and pressure on the collection efficiency and power requirement of typical collection devices are given. It concludes, that particle collection at high temperatures and pressures will be much more difficult and expensive than collection of similar particles at low temperatures and pressures. GRA

N77-25687# Technology Service Corp., Santa Monica, Calif.
EMPIRICAL TECHNIQUES FOR ANALYZING AIR QUALITY AND METEOROLOGICAL DATA. PART 3: SHORT-TERM CHANGES IN GROUND-LEVEL OZONE CONCENTRATIONS: AN EMPIRICAL ANALYSIS Final Report, May 1974 - Oct. 1975
Leo Breiman and W. S. Meisel Jun. 1976 73 p refs 3 Vol.
(Contract EPA-68-02-1704)
(PB-261448/5; TSC-PD-132-1-Pt-3; EPA-600/4-76-029c-Pt-3) Avail: NTIS HC A04/MF A01; also avail. in set of 3 reports PC E06, PB-261445-SET CSCL 13B

An empirical analysis of ambient air quality data for the Los Angeles Basin is used to relate the one- and two-hour changes in oxidant levels in the urban environment to the preceding levels of precursor pollutants and to meteorological variables. The intent was to demonstrate the feasibility of developing a set of empirical difference equations for the production of oxidant over time. The main variables determining one- and two-hour oxidant changes were identified using nonparametric regression techniques. A model for the oxidant changes was developed using nonlinear regression techniques. The implications of the model are discussed. GRA

N77-25688# Environmental Research Lab., Athens, Ga.
EVALUATION OF A PROTOTYPE INSTRUMENT FOR DETERMINING PHOSPHORUS IN WATER Final Report
Thomas B. Hoover and J. MacArthur Long Oct. 1976 25 p refs
(PB-262234/8; EPA-600/4-76-033) Avail: NTIS HC A02/MF A01 CSCL 13B

A second-generation flame spectrometer for the direct determination of phosphorus in water was evaluated. Response to phosphorus in the form of phosphoric acid was linear from 0.5 to 16 ppm phosphorus. The relative standard deviation was approximately constant at 20 percent over the range. River water and municipal sewage effluent were analyzed after the addition of phosphoric acid and filtration through a series of microporous membranes. Recovery of the added phosphorus averaged 70 percent for the river water and 95 percent for the sewage effluent after treatment with cation exchange resin. There was no clear relation to filter pore size in the range 5 to 0.2 micrometers. Analyses of the higher range EPA Nutrient

Reference Samples agreed within one standard deviation with the reference values, both for inorganic and total phosphorus. The lower concentration range samples gave barely detectable signals. GRA

N77-25689# Little (Arthur D.), Inc., Cambridge, Mass.
FOREIGN AIR POLLUTION RESEARCH IN FINE PARTICULATES Final Report, Mar. 1975 - Apr. 1976
Arthur L. Benson Oct. 1976 99 p refs
(Contract EPA-68-02-1866)
(PB-262856/8; EPA-600/2-76-278) Avail: NTIS HC A05/MF A01 CSCL 14B

Unpublished fine particulate measurement and control information in Australia, Canada, Japan, and the USSR is presented. The information is used as a basis for identifying new concepts in the above mentioned area. Approximately 700 documents are compiled with abstracts. Full-text translatons are provided for special-interest areas. GRA

N77-25690# California State Dept. of Transportation, Sacramento. Transportation Lab.
TRANSPORTATION SYSTEMS AND REGIONAL AIR QUALITY. AN APPROACH AND COMPUTER PROGRAM FOR WIND FLOW FIELD ANALYSIS Interim Report
James A. Racin and Andrew J. Ranzieri May 1976 50 p
(PB-263921/9; CA-DOT-TL-7169-4-76-38; FHWA/CA-76/38) Avail: NTIS HC A03/MF A01 CSCL 04B

Regional air quality studies and photochemical simulation models described the wind flow patterns for specific hours of various meteorological regimes. An interdisciplinary team that includes a meteorologist, and air pollution modeler, an environmental planner, and an air quality engineer used plots of wind vectors to design a network of wind monitoring stations. Along with user instructions, input forms, and a computer program, an approach for conducting a wind flow field analysis is presented. GRA

N77-25691# General Electric Co., Pittsfield, Mass. Ordnance Systems.
CARBON DIOXIDE LASER SYSTEM TO MEASURE GASEOUS POLLUTANTS Final Report, May 1974 - May 1975
R. J. Gillmeister and L. R. Snowman Jan. 1977 111 p refs
(Contract EPA-68-02-1290)
(PB-263028/3; EPA-600/2-77-009) Avail: NTIS HC A06/MF A01 CSCL 07D

The development of a gas laser system for air pollution monitoring over long paths, a kilometer or more, using infrared absorption is considered. Modifications to a breadboard system for simultaneous detection of O3, NH3, C2H4 and the addition of beam steering optics to give the system area monitoring capability are discussed. Operation for a two month period in St. Louis in conjunction with the RAPS program is also discussed. Data comparing system performance with that of conventional monitors is presented along with the results of problem investigations. GRA

N77-25692# Harry Diamond Labs., Adelphi, Md.
DIESEL SMOKE METERS FOR ARMY USE
Dennis W. McGuire Nov. 1976 80 p refs
(AD-A035210; HDL-TM-76-17) Avail: NTIS HC A05/MF A01 CSCL 13/2

A study was performed to determine the suitability of existing diesel smoke measuring equipment and techniques for Army use in a program of diesel smoke abatement. Most commercial equipment, and virtually all known techniques were considered in view of possible enforcement, maintenance, or training applications. Attempts were made also to critically evaluate the particular nature of the Army smoke problem so that recommendations could be presented in a realistic perspective. This report gives a detailed summary of the results of this study. Smoke measuring techniques and available commercial equipment are reviewed, and technical criticisms are given. Previous overall studies of the technical aspects of smoke measurement also are reviewed and compared. Existing smoke abatement programs, including Federal and State, and their associated inspection procedures are examined, and attempts at their technical and practical evaluation are presented. The Army smoke problem is examined by reviewing the available technical studies of the problem and by considering information obtained from various knowledgeable individuals through interviews. Several novel techniques for the measurement of diesel smoke are suggested for consideration. GRA

N77-25693# Midwest Research Inst., Kansas City, Mo.
PROCEEDINGS: FINE PARTICLE EMISSIONS INFORMATION SYSTEM USER WORKSHOP
M. P. Schrag Jan. 1977 138 p refs Conf. proc. held at Res. Triangle Park, N. C., 15 Jun. 1976
(Contract EPA-68-02-1324)
(PB-263468/1; EPA-600/7-77-001) Avail: NTIS HC A07/MF A01 CSCL 05B

The Fine Particle Emissions Information System (FPEIS) was described. FPEIS is a computerized information system on fine particle emissions from stationary sources and may contain source test data including particle size distribution; chemical, physical, and bioassay testing results; design and performance data on particle control systems; process descriptions; and descriptions of sampling equipment and techniques employed. GRA

N77-25694# South Florida Univ., St. Petersburg. Dept. of Marine Science.
CALIBRATION OF A THERMAL ENRICHMENT MODEL FOR SHALLOW, BARRICADED ESTUARIES Final Report, Jun. 1975 - Sep. 1976
Kendall L. Carder, Steven L. Palmer, Bruce A. Rodgers, and Paul J. Behrens Sep. 1976 68 p refs
(Contract DI-14-31-001-4232)
(PB-262218/1; W77-03171; OWRT-C-5083(4232)(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

A numerical model of thermal dispersion was developed. The model was linked to an explicit, tidally driven hydraulics model of a barricaded estuary on the west coast of Florida. It was used to predict the distribution of temperature resulting from a seawater-cooled power generation facility near Crystal River, Florida. Manning numbers and diffusion coefficients were determined for the modeled basin and verified by comparing characteristics of the calculated plume to those of the actual plume. Input variables included tidal height, power plant load, solar irradiance, air temperature, humidity, pressure, and wind speed and direction. After five days of simulation for the period 6/15/75 to 6/19/75, the calculated plume area was within 15 percent of the measured acreage, and the calculated mean plume temperature differed from the measured value by only 0.05 C. GRA

N77-25695# Seaward, Inc., Falls Church, Va.
ARCTIC ADAPTS: ENGINEERING ANALYSIS, PROTOTYPE DEVELOPMENT AND TESTING Final Report
Michael L. Clarke, David W. Durfee, and Sidney H. Shaw Dec. 1976 162 p
(Contract DOT-CG-51864-A)
(AD-A035916; USCG-D-123-76) Avail: NTIS HC A08/MF A01 CSCL 13/11

ADAPTS is a portable pumping system consisting of a diesel/hydraulic power supply and an hydraulic motor powered axial flow, submersible turbine pump equipped with the necessary power and discharge hoses, etc., expressly built by the Coast Guard for off-loading damaged tank ships. An engineering study to analyze the feasibility of adapting the Coast Guard's ADAPTS pumping systems for use in an arctic environment is presented. Environmental criteria for this study are air temperatures as low as -40 F, cargo temperature as low as 28 F, and winds up to 40 knots. Results of prototype system testing are discussed, and final recommendations presented, for arctic modification of ADAPTS. Miscellaneous system modifications, changes in lubricating and operating fluids, and procedural changes are discussed. Drawings, parts list and cost information are included for the modifications recommended. GRA

N77-25696# Houston Univ., Tex.
THE COST OF CLEAN WATER IN AMMONIA, CHLORALKALI, AND ETHYLENE PRODUCTION
Russell G. Thompson, James A. Calloway, and Lillian A. Nawalanic 1976 140 p
(Grant NSF GI-344592-2)
(PB-264508/3; ISBN-0-87201-111-9; NSF/RA-760234) Avail:

NTIS HC A07/MF A01 CSCL 07A

National economic plant models were developed for ammonia, chlor-alkali, and ethylene plants to evaluate the economic and technical effects of limiting or not limiting the discharge of any major water, air, or solid waste pollutant. These model plant developments each involved: (1) an identification of the technical substitution possibilities; (2) measurement of the inputs into each process and the outputs, including wastes, from each process; (3) specification of the physical laws and effluent standards restricting the substitution of one production process for another; and (4) organization of the data into a standardized mathematical format for computer evaluation. GRA

N77-25697# Southern Research Inst., Birmingham, Ala.
DEVELOPMENT OF A PORTABLE DEVICE TO COLLECT SULFURIC ACID AEROSOL Interim Report, Jun. 1975 - May 1976
William J. Barrett Feb. 1977 70 p refs
(Contract EPA-68-02-2234)
(PB-264257/7; SORI-EAS-76-397; EPA-600/2-77-027) Avail: NTIS HC A04/MF A01 CSCL 07D

The purpose of this investigation was to determine the effects of possible atmospheric interferents on the quantitative collection of sulfuric acid aerosol on a filter. Sulfuric acid was generated in the laboratory with a flame atomizer and collected on Teflon filters. The filters were exposed to potential gas and vapor interferents and to particulate interferents during, before, or after the collection of the sulfuric acid. Measurements of sulfuric acid were made by an acid-base indicator method or by extraction with benzaldehyde and titration. GRA

N77-25698# Lowell Univ., Mass. Dept. of Chemistry.
GELATION OF OIL SLICKS BY AMINE CARBAMATES AS AN ADJUNCT TO US NAVY OIL SPILL RECOVERY Final Report, 15 Oct. 1975 - 14 Nov. 1976
William W. Bannister 14 Jan. 1977 79 p refs
(Contract N00014-76-C-0340)
(AD-A035702) Avail: NTIS HC A05/MF A01 CSCL 13/2

Solutions of Amine D (dehydroabietylamine 70%) in ethyl and benzyl alcohol, when sprayed on oil slicks to a concentration of about 10% and then treated with CO2 to form the carbamate, provides excellent gelation of the oil. Lab tests were performed on gel strengths and on effects of film thickness, temperature, and salinity for various fuels. A field test indicated that this system is very advantageous in recovery of oil slicks, in terms of ease of pick-up immobilization of the oil, keeping the gelled oil from drifting back over cleared areas and greater visibility of the gelled slick. The toxicity of the Amine D is of a very low order, comparable to that of the oil slick itself for water depths of over two feet, the toxicity is negligible. There is a significant (ca. 50%) reduction in evaporation rate of gelled, compared with ungelled hydrocarbons. This factor would be important in terms of reduced vapor hazards and perhaps fire hazards. Ultraviolet fluorescers as additives to the gelling agent or to the oil slick itself were studied and found to have promise in terms of providing increased visibility for night time operations.
Author (GRA)

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N77-25699 British Library Lending Div., Boston Spa (England).
THE INFLUENCE OF GEOMAGNETIC DISTURBANCES ON PROCESSES IN THE ATMOSPHERE
U. M. Mikhevich [1976] 18 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Geomag. Aeron. (USSR), v. 16, 1976 p 344-350 In ENGLISH and RUSSIAN
(BLL-M-24874-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The effects of variations in the magnetic field on tropospheric processes, and on the subsequent propagation of tropospheric disturbances into higher layers of the atmosphere were investigated. Modelling is based on equations of magnetohydrodynamics with quasi-geostrophic approximation. Author

N77-25700 British Library Lending Div., Boston Spa (England).
THE CONNECTION BETWEEN VARIATIONS IN SURFACE PRESSURE AND SEVERE GEOMAGNETIC DISTURBANCES
V. Ye. Chertoprud [1976] 28 p refs Transl. into ENGLISH from Uses. Nauch.-Issled. Inst. Gidromet. Inf.-Mirov. Tsent. Danny. T. Vyp. (Moscow), v. 23, 1975 p 50-62 In ENGLISH and RUSSIAN
(BLL-M-24826-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The example of two seasons of the year was used to illustrate the suitability of correlation analysis of the simultaneous diurnal differences in surface atmospheric pressure for verifying the reality of the influence of strong geomagnetic disturbances on variations in surface pressure, and for bringing out some of the important properties of that influence. The results given must be taken as a preliminary stage in work on clarifying the link between variations in surface pressure and solar (corpuscular) activity. Author

N77-25701 British Library Lending Div., Boston Spa (England).
THE EFFECT OF OROGRAPHY AND SURFACE FRICTION ON ATMOSPHERIC PRESSURE VARIATIONS
N. Godev [1976] 57 p refs Transl. into ENGLISH from Bulgarian Geoph. J. (Sofia), v. 1, no. 2, 1975 p 43-56 In ENGLISH and RUSSIAN
(BLL-M-24889-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Atmospheric turbulences produced by boundary layers were investigated. The atmosphere is considered as ideal gas and boundary layer conditions are added to the equations of motion to draw an atmospheric model. In such an approach orography and friction are considered as two independently acting factors.
I.M.

N77-25702*# Stanford Research Inst., Menlo Park, Calif.
DESIGN OF AN AIRBORNE LIDAR FOR STRATOSPHERIC AEROSOL MEASUREMENTS Final Report
W. E. Evans May 1977 115 p refs
(Contract NAS1-14520; SRI Proj. 5557)
(NASA-CR-145179) Avail: NTIS HC A06/MF A01 CSCL 04A

A modular, multiple-telescope receiving concept is developed to gain a relatively large receiver collection aperture without requiring extensive modifications to the aircraft. This concept, together with the choice of a specific photodetector, signal processing, and data recording system capable of maintaining approximately 1% precision over the required large signal amplitude range, is found to be common to all of the options. It is recommended that development of the lidar begin by more detailed definition of solutions to these important common signal detection and recording problems. Author

N77-25703*# Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
ON THE ORIGIN OF THE BANGUI MAGNETIC ANOMALY, CENTRAL AFRICAN EMPIRE
Bruce D. Marsh 1977 63 p refs
(Grant NsG-5090)
(NASA-CR-153260) Avail: NTIS HC A04/MF A01 CSCL 08N

A large magnetic anomaly was recognized in satellite magnetometer data over the Central African Empire in central Africa. They named this anomaly the Bangui magnetic anomaly due to its location near the capital city of Bangui, C.A.E. Because large crustal magnetic anomalies are uncommon, the origin of this anomaly has provoked some interest. The area of the anomaly was visited to make ground magnetic measurements, geologic observations, and in-situ magnetic susceptibility measurements. Some rock samples were also collected and chemically analyzed. The results of these investigations are presented. Author

N77-25704*# General Oceanology, Inc., Cambridge, Mass.
GRAVITY GRADIENT PRELIMINARY INVESTIGATIONS, PART 2: LUNAR TIDAL GRAVITY GRADIENTS AND STRESSES (EXHIBIT C) Final Report

Mark H. Houston and Lloyd G. D. Thompson 30 Jan. 1971 48 p refs
(Contract NAS9-9200)
(NASA-CR-151424; GO-15) Avail: NTIS HC A03/MF A01 CSCL 08N

Preliminary analysis of the gravity gradients associated with gravity tides on the moon caused by the earth indicates that the relative changes in the gradients are very irregular, and large, and about 15 times greater than those experienced on earth. Thus gradients, in preference to gravity tides themselves, may well be an important key in correlating tide effects with lunar transient events and moonquakes, and also in determining triggering mechanisms for crustal movement and faulting. Preliminary analysis of lunar crustal stresses and strains caused by lunar gravity tides indicates that these factors may be more direct causative agents or triggering mechanisms. In particular, the cubic dilation undergoes relatively large changes and is about 11 times greater on the moon than on earth. Thus it should be correspondingly more important. Author

N77-25705*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
LABORATORY SIMULATION OF ROCKET-BORNE D-REGION BLUNT PROBE FLOWS
Lee Bernard Kaplan 18 May 1977 164 p refs
(Grants NGL-39-009-003; NsG-6004)
(NASA-CR-153259; PSU-IRL-SCI-456) Avail: NTIS HC A08/MF A01 CSCL 04A

The flow of weakly ionized plasmas that is similar to the flow that occurs over rocket-borne blunt probes as they pass through the lower ionosphere has been simulated in a scaled laboratory environment, and electron collection D region blunt probe theories have been evaluated. Author

N77-25706*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE 1974 ETHIOPIAN RIFT GEODIMETER SURVEY
Paul Mohr 24 Mar. 1977 159 p refs
(Grant NGR-09-015-002)
(NASA-CR-153261; SAO-Special-Rept-376) Avail: NTIS HC A08/MF A01 CSCL 08G

The field techniques and methods of data reduction for five successive geodimeter surveys in the Ethiopian rift valley are enlarged upon, with the considered conclusion that there is progressive accumulation of upper crustal strain, consonant with on-going rift extension. The extension is restricted to the Quaternary volcanotectonic axis of the rift, namely the Wonji fault belt, and is occurring at rates of 3 to 6 mm/yr in the northern sector of the rift valley. Although this concurs with the predictions of platetectonic analysis of the Afar triple junction, it is considered premature to endorse such a concurrence on the basis of only 5 years of observations. This is underlined by the detection of local tectonic contractions and expansions associated with geothermal and gravity anomalies in the central sector of the rift valley. There is a hint of a component of dextral slip along some of the rift-floor fault zones, both from geological evidence and from the strain patterns detected in the present geodetic surveys. Author

N77-25707# Illinois Univ., Urbana. Aeronomy Lab.
SMALL-SCALE FLUCTUATIONS IN D-REGION IONIZATION DUE TO HYDRODYNAMIC TURBULENCE
R. J. Hill and S. A. Bowhill 1 Nov. 1976 406 p refs
(Grant NSF ATM-73-06485)
(UILU-Eng-76-2506) Avail: NTIS HC A18/MF A01

The fluctuations at small length scales in D-region ionization caused by atmospheric turbulence are investigated. Consideration is given to the dynamics of the plasma, the statistical theory of turbulent advection, the relaxation to photochemical equilibrium, and the theoretical prediction of observed scattered power from electron-concentration fluctuations. The electron-neutral and ion-neutral collision frequencies for use in the continuum momentum equation are determined for low-frequency phenomena in the lower ionosphere. It is found that the assumption of a displaced Maxwellian distribution function is not a good approximation for determining such electron-neutral momentum transfer collision frequencies. Those collision frequencies which yield transport coefficients in agreement with kinetic theory are determined. Author

N77-25708*# California Inst. of Tech., Pasadena. Seismological Lab.
THE DISTRIBUTION OF SEISMIC VELOCITIES AND ATTENUATION IN THE EARTH Ph.D. Thesis
Robert Stuart Hart 1977 364 p refs
(Grant NGL-05-002-069; Contract F49620-77-C-0022)
(NASA-CR-153248) Avail: NTIS HC A16/MF A01 CSCL 17J

Estimates of the radial distribution of seismic velocities and density and of seismic attenuation within the earth are obtained through inversion of body wave, surface wave, and normal mode data. The effect of attenuation related dispersion on gross earth structure, and on the reliability of eigenperiod identifications is discussed. The travel time baseline discrepancies between body waves and free oscillation models are examined and largely resolved. Author

N77-25709*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RELATIONSHIP BETWEEN AURORAL SUBSTORMS AND THE OCCURRENCE OF TERRESTRIAL KILOMETRIC RADIATION
M. L. Kaiser and J. K. Alexander Mar. 1977 15 p refs Submitted for publication
(NASA-TM-X-71323; X-695-77-40) Avail: NTIS HC A02/MF A01 CSCL 04A

The correlation between magnetospheric substorms as inferred from the AE(11) index and the occurrence of terrestrial kilometric radiation (TKR) is examined. It is found that AE and TKR are well correlated when observations are made from above the 15-03 hr local time zone and are rather poorly correlated over the 03-15 hr zone. High-resolution dynamic spectra obtained during periods of isolated substorms indicate that low-intensity, high-frequency TKR commences at about the same time as the substorm phase. The substorm expansion phase corresponds to a rapid intensification and bandwidth increase of TKR. When combined with previous results, these new observations imply that many TKR events begin at low altitudes and high frequencies (about 400-500 kHz) and spread to higher altitudes and lower frequencies as the substorm expands. Author

N77-25710*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR GENERATED QUASI-BIENNIAL GEOMAGNETIC VARIATION
Masahisa Sugiura and D. J. Poros (Computer Sciences Corp., Silver Spring, Md.) Mar. 1977 32 p refs Submitted for publication
(NASA-TM-X-71325; X-625-77-74) Avail: NTIS HC A03/MF A01 CSCL 08N

The existence of highly correlated quasi-biennial variations in the geomagnetic field and in solar activity is demonstrated. The analysis uses a numerical filter technique applied to monthly averages of the geomagnetic horizontal component and of the Zurich relative sunspot number. Striking correlations are found between the quasi-biennial geomagnetic variations determined from several magnetic observatories located at widely different longitudes, indicating a worldwide nature of the obtained variation. The correlation coefficient between the filtered Dst index and the filtered relative sunspot number is found to be -0.79 at confidence level greater than 99% with a time-lag of 4 months, with solar activity preceding the Dst variation. The correlation between the unfiltered data of Dst and of the sunspot number is also high with a similar time-lag. Such a timelag has not been discussed in the literature, and a further study is required to establish the mode of sun-earth relationship that gives this time delay. Author

N77-25711*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF LARGE TRANSIENT MAGNETOSPHERIC ELECTRIC FIELDS
T. L. Aggson and J. P. Heppner Mar. 1977 47 p refs Submitted for publication
(NASA-TM-X-71334; X-625-77-135) Avail: NTIS

HC A03/MF A01 CSCL 04A

Transient electric field events were observed with the long, double probe instrumentation carried by the IMP-6 satellite. Nine, clearly defined, exceptionally large amplitude events are presented here. The events are observed in the midnight sector at geocentric distances 3.5 to .5.5 R sub e at middle latitudes within a magnetic L-shell range of 4.8 to 7.5. They usually have a total duration of one to several minutes, with peak power spectra amplitudes occurring at a frequency of about 0.3 Hz. The events occur under magnetically disturbed conditions, and in most cases they can be associated with negative dH/dt excursions at magnetic observatories located near the foot of the magnetic field line intersecting IMP-6. The magnetospheric motions calculated for these electric fields indicated a quasi-stochastical diffusive process rather than the general inward magnetospheric collapsing motion expected during the expansive phases of auroral substorm activity. Author

N77-25712# Montpellier Univ. (France). Dept. de Physique Mathematique.

ON GEOPHYSICAL INVERSE PROBLEMS AND CONSTRAINTS

P. C. Sabatier Sep. 1976 41 p refs Presented at the 11th Intern. Symp. on Math. Geophys., Seeheim, West Ger., 18-27 Aug. 1976

(PM/76/8) Avail: NTIS HC A03/MF A01

Mathematical methods for linearized geophysical inverse problems are reviewed in cases with and without constraints. The role of constraints receives particular attention both in linear convex problems and in an exactly solvable nonlinear example. Author (ESA)

N77-25713# Royal Netherlands Meteorological Inst., De Bilt.

DETERMINATION OF EARTHQUAKE FOCAL MECHANISM. DESCRIPTION OF SIX COMPUTER PROGRAMS

T. DeCrook 1976 22 p refs

(KNMI-WR-76-18) Avail: NTIS HC A02/MF A01

Six computer programs were developed by several investigators in order to determine the focal mechanism of an earthquake. These programs were rewritten for the Burroughs B6700. The programs are briefly described, especially for the users of the programs. Some rules are given for the choice of the best program. Author (ESA)

N77-25714# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DISPERSION WITHIN THE STRATOSPHERE OF MINOR CONSTITUENTS Ph.D. Thesis - Toulouse Univ., 1976

Anne-Marie Bouchardy Jan. 1977 127 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-381)

(ONERA-P-1976-7; FR-ISSN-0078-379X) Avail: NTIS HC A07/MF A01

The experimental method consists in creating artificial clouds within the stratosphere, and in observing their evolution from the ground. The observation means used are either a lidar and a still camera, or two ballistic chambers and two still cameras. The measurements carried out allow determination of cloud motion and cloud sizes, during an average of 600 sec. A numerical model was realized which makes it possible to simulate the evolution of these clouds and to emphasize the influence of turbulent mixing and wind shear. With this model and experimental results the horizontal diffusion coefficients and their variations with scale can be determined. The values found are between 0.5 and 11 sq m/s, for a time of 300 sec. Some values of the vertical diffusion coefficient were also measured. The results obtained are discussed. A study of the microstructure of clouds permitted the study of the phenomena at a smaller scale. Author (ESA)

N77-25715# Kiruna Geophysical Inst. (Sweden).

STUDIES OF INFRASONIC WAVES IN THE AURORAL ZONE

Hans Westin Nov. 1976 8 p refs Sponsored in part by Swed. Natural Sci. Res. Council

(Grant NSF GA-41918)

(KGI-76-5) Avail: NTIS HC A02/MF A01

The following papers are presented: (1) on the origin of infrasound background at 1.9 Hz; (2) detection of 2 Hz infrasound by moving auroral electrojects; (3) studies of auroral infrasonic waves in the 0.1 to 0.01 Hz range; (4) buoyancy waves in the surface inversion during the subartic winter; (5) a comparison of auroral in waves in the 0.1 to 0.01 Hz range with simultaneous signal on the 2 Hz receiver; (6) the 2 Hz infrasound and geomagnetic activity; (7) studies of auroral infrasonic substorms; and (8) infrasound waves of auroral origin. ESA

N77-25716# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

EFFECT OF HORIZONTAL REINFORCEMENT ON STABILITY OF EARTH MASSES Final Report, Jul. 1974 - Jun. 1976

Mosaid M. Al-Hussaini and Edward B. Perry Sep. 1976 109 p refs

(AD-A036120; WES-TR-S-76-11) Avail: NTIS HC A06/MF A01 CSCL 08/13

Reinforced earth consists primarily of soil whose engineering properties and performance have been improved by the introduction of small quantities of frictional material that possesses a relatively high tensile strength and modulus of elasticity. The design concept of reinforced earth is based on the assumption that the induced lateral force of a restrained soil mass under load will be resisted by frictional forces that develop between the reinforcement and the surrounding soil. This practical concept has been applied to the problem of stabilizing slopes, retaining walls, pavements, and other applications as described in the literature review. The objectives of this study were: (a) to investigate the uncertainties concerning the stress-strain distribution and the interrelation between the reinforcement and the surrounding soil, and (b) to evaluate the performance of neoprene-coated nylon fabric (membrane) versus galvanized steel as reinforcing material within a cohesionless soil mass. These two objectives were directed toward the feasibility of using the concept of reinforced earth in Corps of Engineers projects. GRA

N77-25717# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

SELECTED EXAMPLES OF RADIOHM RESISTIVITY SURVEYS FOR GEOTECHNICAL EXPLORATION Special Report

P. Hoekstra, P. V. Sellmann, and A. J. Delaney Jan. 1977 21 p refs

(DA Proj. 4A7-62719-AT-24)

(AD-A035761; CRREL-SR-77-1) Avail: NTIS HC A02/MF A01 CSCL 08/7

Measurements of ground resistivity using radio wave techniques have been made in support of several geotechnical projects. Examples of surveys conducted for locating and evaluating gravel deposits, for delineating permafrost, and for extrapolating subsurface information between drill holes are used to illustrate some advantages of ground and airborne surveys using this method. Author (GRA)

N77-25718# Danish Meteorological Inst., Copenhagen. Geophysical Dept.

IONOSPHERIC RESEARCH USING SATELLITES Final Scientific Report, 1 Nov. 1971 - 30 Sep. 1976

Aster Lundbak and Ib Steen Mikkelsen 30 Dec. 1976 18 p refs

(Grant AF-AFOSR-2161-72; AF Proj. 4643)

(AD-A036046; AFGL-TR-77-0036) Avail: NTIS HC A02/MF A01 CSCL 04/1

Amplitude scintillation records have been obtained of the 136 MHz beacon signal of the polar orbiting satellite NIMBUS 4. The records have been made at Narssarssuaq, Greenland, and cover the local time interval 22-02 of the auroral oval. The average behavior of scintillation versus zenith and azimuth is compared to a theoretical index deduced using weak scattering theory. The ionospheric irregularities are represented by a power law spectrum proportional to the inverse 4-th power of k, where k is the irregularity wave number. The comparison shows that the irregularities are elongated along the field lines with an elongation factor equal/to or greater than 2.5. Probably they are also elongated in the magnetic eastwest direction with an elongation factor slightly greater than one. The night time scintillation corrected for geometric variation shows a marked

increase when moving from sub-auroral to auroral oval latitudes. Author (GRA)

N77-25719# Naval Surface Weapons Center, White Oak, Md.
MAGNETOSTRICTION AND STRUCTURAL DISTORTION IN RARE EARTH INTERMETALLICS
James R. Cullen and Arthur E. Clark 1 Nov. 1976 27 p refs (RR0220601)
(AD-A035484; NSWC/WOL/TR-75-177) Avail: NTIS HC A03/MF A01 CSCL 11/6

On the basis of the special symmetry of the rare earth site in the Laves pict the occurrence of a structural distortion which vanishes only when (100) is the easy magnetization direction. An extraordinary external strain accompanies the distortion and provides an explanation of the observed size and anisotropy of the magnetostriction in RFe2. Author (GRA)

N77-25720# Durham Univ. (England). Dept. of Physics.
PHYSICAL CHARACTERISTICS OF THE NATURAL ATMOSPHERIC AEROSOL Final Technical Report, Mar. 1975 - Sep. 1976
S. Gerard Jennings Oct. 1976 109 p refs
(Contract DAJA37-75-C-1913; DA Proj. 1T1-61102-B-53B)
(AD-A036088) Avail: NTIS HC A06/MF A01 CSCL 04/1

In this report an analysis is made of continuous measurements of the number and size distribution of submicrometer and large aerosol particles up to 5 micrometers in radius. An automated optical particle counter was used to take measurements at a 10 minute sampling frequency over a 49 day period at Durham Observatory, near Durham City, North East of England. Additional measurements were made at a remote mountain station at Great Dun Fell, 842 m msl and at an isolated maritime site. The averaged diurnal variation shows a maximum in particle number concentration from about 0200-0800 local time and a distinctive minimum over the period 1400-2000 hours. The particle number concentration follows a long-normal distribution. An analysis of the sampling frequency shows that the measurements could be made less frequently by factors up to 20, without loss of significant information. GRA

N77-25721# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A REVIEW OF ATMOSPHERIC TRANSMISSION INFORMATION IN THE OPTICAL AND MICROWAVE SPECTRAL REGIONS Final Report
Alan R. Downs Dec. 1976 59 p refs
(AD-A035059; BRL-MR-2710) Avail: NTIS HC A04/MF A01 CSCL 04/1

Much information has been generated over a long period of time on the transmission through the atmosphere of radiation of various wavelengths. This report represents an attempt to consolidate some of the available information into a single report. This report addresses five wavelengths each in the optical and microwave regions. Attenuation mechanisms considered are Rayleigh and Mie scattering and absorption by both water vapor and water drops. Atmospheres characterized by visibilities between 0.1 km (fog) and 325 km (clear air) and by rainfalls at rates up to 64 mm/hr are considered. Pertinent formulations and tables are provided to assist in calculating attenuation coefficients characteristic of a wide variety of atmospheres, and the adequacy of the data bases upon which such calculations rest is assessed. A limited amount of information is also provided on the attenuation characteristics of smoke and dust. Author (GRA)

N77-25722# Germantown Labs., Inc., Philadelphia, Pa.
CHEMICAL RELEASE PAYLOADS FOR THE WINTER ANOMALY PROGRAM (1976), ICE CAP PROGRAM (1976) AND OPERATION HARSES (1976) Final Report, 1 Oct. 1975 - 30 Sep. 1976
Charles S. Stokes, William J. Murphy, and Edward W. Smith Hanscom AFB, Mass. AFGL 30 Oct. 1976 24 p refs
(Contract F19628-76-C-0056)
(AD-A035514; AFGL-TR-76-0312) Avail: NTIS HC A02/MF A01 CSCL 04/1

This report covers the work performed in support of the chemical payloads for the Winter Anomaly Program, January 1976 launch series from NASA Wallops Station, Virginia, the Ice Cap Program, spring 1976 launch series and the two launch series of May 1976 and July 1976 for Operation Harses from the White Sands Missile Range, New Mexico. These operations included design, fabrication, assembly and launch services for chemical payloads containing trimethyl aluminum and/or titanium tetrachloride-methanol/water mixtures. Author (GRA)

N77-25723# Information Design, Inc., Bedford, Mass.
ANALYSIS OF CHEMICAL SMOKE RELEASES TO CHARACTERIZE STRATOSPHERIC/THERMOSPHERIC WIND FIELDS Final Report, 1 Jan. - 1 Nov. 1976
Sheldon B. Michaels, Jeffrey S. Morris, and Otis Philbrick Nov. 1976 9 p refs
(Contract F19628-76-C-0139)
(AD-A035515; AFGL-TR-77-0007) Avail: NTIS HC A02/MF A01 CSCL 04/2

New interactive computer programs were used to measure the coordinates of smoke puff centers for a series of releases Paradise Aeolus in the thermosphere at Fort Churchill, Canada, in April 1975. Position data for triangulation of smoke trail releases at White Sands Missile Range Stratospheric Winds, and Wallops Island Winger Anomaly were also measured, digitized and recorded on magnetic tape. Author (GRA)

N77-25724# Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab.
AIRBORNE MEASUREMENTS OF OPTICAL ATMOSPHERIC PROPERTIES IN NORTHERN GERMANY Interim Report
Siebert Q. Duntley, Richard W. Johnson, and Jacqueline I. Gordon Sep. 1976 241 p refs
(Contract F19628-76-C-0004)
(AD-A035571; SIO-Ref-76-17; AFGL-TR-76-0188; SR-6) Avail: NTIS HC A11/MF A01 CSCL 04/1

This report presents daytime atmospheric optical data collected chiefly with airborne instruments during a field expedition to northern Germany in the spring of 1973. Results from seven relatively low altitude flights are presented. The data include the natural irradiance upon horizontal plane surfaces, scalar irradiances, total volume scattering coefficients, atmospheric beam transmittances, path radiances, directional path reflectances and directional sky and terrain reflectance. Data for daytime conditions ranging from scattered clouds to completely overcast were derived for upward- and downward-looking paths of sight inclined at seven zenith angles (0, 75, 80, 85, 95, 100, 180 degrees) from altitudes of 1,200 m above ground level and lower. Data were measured in four spectral regions, as follows; Three narrow band optical filters with mean wavelengths of 478, 664, and 765 nanometers, and one broad band sensitivity representing a pseudo-photopic response with a mean wavelength of 557 nanometers. Author (GRA)

N77-25725# Woods Hole Oceanographic Institution, Mass.
GRAVITY DATA PROCESSING PROGRAMS
Carl Bowin Jan. 1977 506 p refs
(Contract N00014-74-C-0262; NR Proj. 083-004)
(AD-A035454; WHOI-77-2) Avail: NTIS HC A22/MF A01 CSCL 08/5

A summary and documentation of a family of computer programs that have been developed by the gravity group at the Woods Hole Oceanographic Institution is presented. The programs provide for format conversion, computation of regional gravity field from spherical harmonic coefficients, selective data retrieval, graphic display, and construction of two- and three-dimensional structure models and the computation of the gravitational attraction of those models. GRA

N77-25726# National Oceanic and Atmospheric Administration, Boulder, Colo.
AURORAL ELECTROJET MAGNETIC ACTIVITY INDICES AE(11) FOR 1974
Joe Haskell Allen, Carl C. Abston, and Leslie D. Morris Dec. 1976 150 p refs
(PB-263927/6; UAG-59; NOAA-77010301) Avail: NTIS HC A07/MF A01 CSCL 04A

The Auroral Electrojet index (AE) is discussed, and a brief description is given of the derivation of 11-station 2.5-min AE indices for 1974. Tables are given of hourly average indices for each day of the year, the stations making the main contribution to the hourly indices, and of the average monthly quiet-time

level of horizontal fields (H) at each magnetic observatory. Graphs of the index variations are included for each day of 1974. GRA

N77-25727# Boston Univ., Mass. Dept. of Astronomy.
THE IONOSPHERIC F-REGION NEAR 60 DEG MAGNETIC LATITUDE: MONTHLY MEAN BEHAVIOR SUBSTORM EFFECTS DURING WINTER NIGHTS Annual Report, Sep. 1975 - 31 Aug. 1976
Michael Mendillo and Michael Buonsanto Sep. 1976 169 p refs
(AF Proj. 4643)
(AD-A035940; Ser-2-No-61; AFGL-TR-76-0233) Avail: NTIS HC A08/MF A01 CSCL 04/1

The aim of the study is to provide the first detailed look at the morphology of the ionospheric F-region near a geomagnetic latitude of 60 degrees. This region is of considerable interest because it lies at the base of the geomagnetic field line which forms the average boundary of the plasmasphere, the geomagnetic field-aligned envelope of co-rotating plasma which extends to approximate total electron content TEC is the total number of electrons in a vertical column of unit cross sectional area extending through the ionosphere. It is obtained by measuring the amount of Faraday rotation a plane polarized wave experiences in traveling from a satellite-borne radio beacon to a ground receiving station. The peak value of the electron concentration's vertical profile, denoted N max, is obtained from ground-based ionosonde measurements of the ionosphere's critical (or vertical penetration) frequency. The ratio of TEC/N max is called the ionospheric equivalent slab thickness, a first-order measure of the shape of the Ne H profile. GRA

N77-25728# Lockheed Missiles and Space Co., Palo Alto, Calif.
ION AND NEUTRAL CHEMISTRY OF THE D-REGION DURING THE INTENSE SOLAR PARTICLE EVENT OF AUGUST 1972 Final Report, 15 May 1975 - 30 Nov. 1976
R. C. Gunton, R. E. Meyerott, and J. B. Reagan Jan. 1977 94 p refs
(Contract N00014-75-C-1139; NR Proj. 087-135)
(AD-A035283; LMSC-D556351) Avail: NTIS HC A05/MF A01 CSCL 04/1

During the intense solar particle event of 3 through 11 August 1972 (SPE72), simultaneous observations were made with the polar-orbiting satellite 1971-089A and the incoherent scatter radar at Chatanika, Alaska. Combining the ion-pair production rate profiles for the D-region determined from the satellite measurements with electron density profiles at altitudes from 50 to 90 km obtained with the radar at 28 times, principally over a 2-day period, has resulted in an extensive set of effective electron loss rates. The data are sufficiently accurate and contiguous in time that a detailed understanding of the diurnal behavior of the highly disturbed polar D-region ionosphere and neutral atmosphere has been obtained. A conclusion of the present study is that our understanding of the positive ion chemistry of the D-region is adequate to explain electron loss rates under SPE-disturbed conditions provided that proper values are used for the atmospheric density, temperature, and minor species concentrations. Our present understanding of the negative ion chemistry is, however, not adequate to explain the SPE72 results. The presently accepted daytime electron detachment processes at altitudes near 60 km underestimate the observed electron densities and hence the magnitude of radiowave absorption. The study suggests that there must exist undiscovered channels involving photodetachment, photodissociation, and chemical reactions through which electrons are freed from the complex ions formed from negative oxygen ions. GRA

N77-25729# Emmanuel Coll., Boston, Mass.
INVESTIGATION OF MICROPULSATION ACTIVITY. 1: MAGAF SYSTEM ADDITIONS. 2: DATA ANALYSIS Report, 1 Aug. 1975 - 30 Jun. 1976
William F. Bellew, Charles J. Cantor, and M. Patricia Hagan Aug. 1976 99 p
(Contract F19628-76-C-0013)
(AD-A035941; Scientific-1; AFGL-TR-76-0244) Avail: NTIS HC A05/MF A01 CSCL 17/6

The Micropulsation Analysis for Geomagnetic Activity Forecasting (MAGAF) data processing system is in operation at AFGL. System additions are described and programs are listed. Processing of the data has included multiple correlation, filtering, and spectral analysis. These programs are described and listed in this report. Author (GRA)

N77-25730# State Univ. of New York, Albany. Atmospheric Sciences Research Center.
OZONE MEASUREMENTS IN RURAL AREAS
Volker A. Mohnen, A. Hogan, Robert Whitby (N.Y. State Dept. of Environ. Protection), and Peter Coffey (N.Y. State Dept. of Environ. Protection) 12 Nov. 1976 8 p refs Presented at Symp. on the Non-Urban Tropospheric Composition, Hollywood, Fla., 10-12 Nov. 1976
(Contract N00014-76-C-0283)
(AD-A037360) Avail: NTIS HC A02/MF A01 CSCL 04/1

Ozone measurements made at several surface stations in New York and Massachusetts show typical continental diurnal variation; a mountaintop (850 mb) station in the same region experiences very little diurnal variation. The mountaintop ozone concentration always exceeds that of the surface stations, and this concentration trend is predictable by meteorological analysis. The results of these experiments indicate that the ozone source level lies above 850 mb. GRA

N77-25731# Texas Univ., El Paso. Dept. of Electrical Engineering.
STRATCOM-RELATED PHOTODISSOCIATION RATES AND SOLAR FLUX INTENSITIES
Jerry L. Collins Feb. 1977 36 p refs
(Contract DAAD07-74-C-0263)
(AD-A037644; ECOM-77-1) Avail: NTIS HC A03/MF A01 CSCL 04/1

Rates for twenty-three photodissociation processes of O2, O3, NO2, NO3, N2O, N2O5, HO2, H2O2, HNO2, HNO3, CO2, CH4, and HCHO are reported for the maximum solar zenith angle on September 21, 1975, at 32 deg north latitude. These conditions correspond closely to those of the balloon launches made as a part of the Stratospheric Composition (STRATCOM) research program of the Atmospheric Sciences Laboratory (ASL). This program is designed to study the structure and composition of the upper atmosphere, and the calculated values are provided as input data for the supportive modeling effort. Model-predicted solar flux intensities are compared to the intensities measured experimentally on the STRATCOM VI balloon flights made September 24-25, 1975. Author (GRA)

N77-25732# University Coll., London (England). Dept. of Physics and Astronomy.
DETERMINATION OF AIR DENSITY, TEMPERATURE AND WINDS AT HIGH ALTITUDE Final Report, 1 Feb. 1972 - 31 Dec. 1976
Gerald V. Groves 31 Jan. 1977 119 p refs
(Grant AF-AFOSR-2264-72; AF Proj. 8605)
(AD-A037860; AFGL-TR-77-0068) Avail: NTIS HC A06/MF A01 CSCL 04/1

The research performed is described in ten papers published by the principal investigator on the subjects of tidal and quasi-biennial oscillations. The report includes copies of these papers and a review of the analyses which have been carried out on the observation and theory of tidal oscillations and the conclusions reached. GRA

N77-25733# Stanford Research Inst., Menlo Park, Calif. Molecular Physics Center.
ENERGY TRANSFER REACTIONS OF ATMOSPHERIC INTEREST Final Report, 1 Jan. 1974 - 31 Dec. 1976
Tom G. Slanger and Graham Black 23 Feb. 1977 16 p refs
(Contract DAAG29-74-C-0003; SRI Proj. PYU-3070)
(AD-A037162; SRI-MP-77-15; ARO-11553.4-C) Avail: NTIS HC A02/MF A01 CSCL 04/1

Three main areas have been investigated during the term of this contract: (1) The kinetics of the sources and sinks of O(1S) in the lower thermosphere have been studied. Measurements have been made of the temperature-dependent rate of the reaction O(1S) O(3P) goes to 2O. The production of O(1S) in an oxygen atom system has been investigated, and comparisons have been made between the so-called Barth mechanism, in which O(1S) is produced from ground state atoms in a two-step process, and the one-step Chapman mechanism. The temperature

dependence of this O(1S) source term has been obtained. On the basis of atmospheric observations, the conclusion is drawn that a better correlation exists between measured oxygen atom concentration profiles and the laboratory data if the source of O(1S) in the nightglow is the Barth, rather than the Chapman, mechanism. (2) A determination of quenching rate coefficients for the NO(B2 pi) state has been made, using a variety of collision partners. This state, the source of the NO B-band system, is important in combustion processes. (3) The first measurements of the product channels in O(1S) reactions have been carried out, using the five collision partners N2O, H2O, CO2, O2, and NO. All the reactions give high yields of physical quenching, with only H2O and possibly N2O having significant chemical reaction pathways--50% in the former case, and either 25% or 65% in the latter. Several of these reactions are of practical importance, and the behavior of a system having two alternatives for a physical quenching step O(3P) or O(1D) is also interesting from a theoretical standpoint. Author (GRA)

N77-25734# RAND Corp., Santa Monica, Calif.
A FAST NUMERICAL METHOD FOR EXPLICIT INTEGRATION OF PRIMITIVE EQUATIONS NEAR THE POLES
Michael E. Schlesinger Jul. 1976 53 p refs
(Contract DAHC15-73-C-0181; Grant NSF OCD-75-16923)
(AD-A037908; P-5507) Avail: NTIS HC A04/MF A01 CSCL 04/2

In this paper the three-point method is analyzed and compared to the Fourier method for the numerical solution of the primitive equations in the polar regions. It is shown that the original definition of the latitudinally-dependent parameters of the three-point method results in insufficient frequency reduction compared to the Fourier method. A suitable redefinition of these parameters gives a three-point method that is stable with the time step of the Fourier method, although to prevent the modified frequency from becoming zero in high latitudes requires excessive computation. Consequently the three-point and Fourier methods are combined to form a hybrid method, which is twice as fast as the original Fourier method. An additional doubling of the speed of the hybrid method is achieved by a simple improvement of the Fourier Transform used in the Fourier method. The hybrid method has allowed the time step of the Rand atmospheric GCM to be increased from six to ten minutes with a resultant decrease in time requirement of 37%. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-25735 British Library Lending Div., Boston Spa (England).
ON THE ACCURACY OF RECORDS OF THE CAMPBELL-STOKES SUNSHINE RECORDER
M. Bider [1977] 33 p refs Transl. into ENGLISH from Arch. Met. Geoph. Bioklim. (West Ger.), v. 9, no. 3, 1958 p 199-230
(BLL-M-24832-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Campbell-Stokes sunshine recorder is evaluated and the results of simultaneous measurements carried out at Basel with this apparatus and with the heliochronograph of Maurer are discussed. Their different sensitivities with regard to the sun's elevation at the start of registration, loss of sunshine duration on cloudless days and the daily variation in sunshine duration for radiation intensities are compared. Errors arising from excessive burning and their consequences for the total sunshine duration and its daily variation are discussed as well as for the number of hours with uninterrupted insolation. Study of the frequency distribution of hours with a given duration of sunshine, of days with a given total insolation and of the sum of relative insolation and cloudiness suggests an international standardization of instruments and methods of evaluation. Author

N77-25736 British Library Lending Div., Boston Spa (England).
THE CYCLICITY OF THE ATMOSPHERIC CIRCULATION IN THE NORTHERN HEMISPHERE
S. G. Agarkov, Z. P. Konovalenko, and N. K. Kononova [1976] 10 p refs Transl. into ENGLISH from Akad. Nauk. Izv., Ser., Georg. (Moscow), no. 1, 1976 p 94-101
(BLL-M-24844-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Statistical analysis of long-term fluctuations in the atmospheric circulation of the Northern Hemisphere were conducted using the spectral analysis method. The differences are brought out in the periods of the cycles of the various genetic groups. Cyclic fluctuations of precipitation over eastern Siberia are shown to be fully in agreement with cyclic fluctuations of precipitation of the elementary circulation mechanisms. Author

N77-25737*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MESOSCALE CLOUD PHENOMENA OBSERVED BY LANDSAT
James P. Ormsby Washington Jun. 1977 36 p refs
(NASA-TN-D-8494; G-7702) Avail: NTIS HC A03/MF A01 CSCL 04B

Examples of certain mesoscale cloud features - jet cirrus, eddies/vortices, cloud banding, and wave clouds - were collected from LANDSAT imagery and placed into Mason's four groups of causes of cloud formation based on the mechanism of vertical motion which produces condensation. These groups are as follows: (1) layer clouds formed by widespread regular ascent; (2) layer clouds caused by irregular stirring motions; (3) convective clouds; and (4) clouds formed by orographic disturbances. These mechanisms explain general cloud formation. Once formed, other forces may play a role in the deformation of a cloud or cloud mass into unusual and unique meso- and microscale patterns. Each example presented is followed by a brief discussion describing the synoptic situation, and some inference into the formation and occurrence of the more salient features. No major attempt was made to discuss in detail the meteorological and topographic interplay producing these mesoscale features. Author

N77-25738*# Stanford Univ., Calif. Inst. for Plasma Research.
GEOPHYSICAL PREDICATIONS: SUN-WEATHER
John M. Wilcox Mar. 1977 23 p refs
(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grants NSF ATM-74-19007; NSF DES-75-15664)
(NASA-CR-153257; SU-IPR-687) Avail: NTIS HC A02/MF A01 CSCL 04B

The present status of sun-weather research is summarized. Recommendations for future research are given. Author

N77-25739# International Meteorological Inst., Stockholm (Sweden).
[METEOROLOGICAL ACTIVITIES] Annual Report, Jul. 1975 - Jun. 1976
Oct. 1976 29 p refs
(AR-75-76) Avail: NTIS HC A03/MF A01

Research activities for the year 1975/76 in the following fields are reviewed: atmospheric chemistry, atmospheric physics, dynamic meteorology, and geophysical fluid mechanics. Also included are visiting scientists, lists of publications and finances. ESA

N77-25740# World Meteorological Organization, Geneva (Switzerland).
WEATHER AND WATER
1977 26 p refs
(WMO-463; ISBN-92-63-10463-8) Avail: NTIS HC A03/MF A01; WMO; Geneva

The importance of water in the world today is emphasized and the hydrological cycle described. Aspects of hydrology - damming, irrigation, water loss, water supply - are noted, and the role of WMO, particularly in developing countries, in water resources development, and hydrological activities is discussed. ESA

N77-25741# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
COMPARISON OF FULL SCALE WIND CLIMATE AROUND A HIGH-RISE BUILDING WITH TUNNEL TESTS ON A MODEL

R. Poestoke, F. X. C. M. VanLindert (Utrecht Univ.), J. W. G. VanNunen, and L. A. Conrads (Utrecht Univ.) 26 Apr. 1976 21 p refs
(NLR-MP-76009-U) Avail: NTIS HC A02/MF A01

Field measurements were conducted to determine both wind speed and wind direction around a high-rise building. Similar data was collected in a series of wind tunnel tests on a scale model of the building complex. The wind tunnel tests included the simulation of a wind speed profile according to the power law with an exponent of 0.28. Comparison of full scale results with those from model tests revealed a satisfactory agreement, not only for flow patterns, but also for quantitative values of wind speeds, provided the reference station for free stream wind speed and wind direction at full scale was carefully selected.
Author (ESA)

N77-25742# Wisconsin Univ., Madison. Space Science and Engineering Center.
STUDIES OF THE ATMOSPHERE USING AEROSPACE PROBES 1975 Annual Scientific Report
Verner E. Suomi, W. R. Barchet, K. G. Bauer, S. Limaye, and C. S. Lo Aug. 1976 100 p refs
(Grant NOAA-04-3-158-61)
(PB-265279/0; NOAA-77030206) Avail: NTIS HC A05/MF A01 CSCL 04B

This report consists of four technical articles: Wind Observations from the U.S.N.S. Vanguard during GATE Phase 1; Propagation of Cloud Patterns over the Tropical Eastern Pacific, South America, and the Atlantic; A comparison of cloud motion winds extracted from SMS-I infrared images with coinciding radiosonde winds over North America; and stability of the lower atmosphere of Venus: A dry adiabatic diagram based on Van der Waal's equation of state. GRA

N77-25743# New York Sea Grant Inst., Albany.
MARINE CLIMATOLOGY
Bernhard Lettau, William A. Brower, Jr., and Robert G. Quayle Dec. 1976 244 p refs Sponsored by NOAA
(PB-264789/9; NYSSGP-AM-76-024; NOAA-77021612; Atlas-Mono-7) Avail: NTIS HC A11/MF A01 CSCL 04B

The marine climatology of New York Bight is presented both as summaries of available data on those meteorological variables that make up the climate and as interactive processes among land, sea, and air that influence the meteorological variables, and produce the distinctive marine climate. The data summaries consist of monthly averages of temperature, temperature anomalies, heating degree days, relative humidity, precipitation, wind, fog, and haze over the eastern, central, and southern portions of the Bight. The climate-forming processes active over the Bight include the effect of the heat reservoir on the sea surface, the sea breeze, and the effect of coastal geography on storms. GRA

N77-25744# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data Service.
SEPARATION OF MIXED DATA SETS INTO HOMOGENEOUS SETS
Harold L. Crutcher and Raymond L. Joiner Jan. 1977 185 p refs
(PB-264813/7; NOAA-TR-EDS-19; NOAA-77020701) Avail: NTIS HC A09/MF A01 CSCL 04B

The use of a clustering technique to separate mixed data sets into subsets which exhibit group characteristics is illustrated. The relative importance of the subsets, and the nature of the subsets are assessed, and an assumption is made as to whether a particular subset is biased, contaminated, or adulterated. That is, an assessment of the quality of the data may be made. The techniques are applicable to any data set which is multivariate normal. GRA

N77-25745# National Oceanic and Atmospheric Administration, Washington, D. C.
PROCEEDINGS OF THE NOAA CLIMATE DIAGNOSTICS WORKSHOP
William A. Sprigg and Robert Etkins Nov. 1976 311 p Workshop held at Washington, D. C., 4-5 Nov. 1976
(PB-264993/7; NOAA-77021004) Avail: NTIS HC A14/MF A01 CSCL 04B

Climate diagnostic studies are summarized and evaluated.
I. M.

N77-25746# National Oceanic and Atmospheric Administration, Washington, D. C. Center for Experiment Design and Data Analysis.
GATE CONVECTION SUBPROGRAM DATA CENTER: ANALYSIS OF RAWINSONDE INTERCOMPARISON
Robert Reeves, Scott Williams, Eugene Rasmussen, Donald Acheson, James Rasmussen (World Meteorol. Organ., Geneva, Switzerland), and Thomas Carpenter Nov. 1976 86 p refs
(PB-264815/2; NOAA-TR-EDS-20; NOAA-77020702) Avail: NTIS HC A05/MF A01 CSCL 04B

A comparative analysis of GATE rawinsonde temperature, humidity, and winds is described. Data from the formal Comparison Periods and Phases I and III from the United States, the Federal Republic of Germany, Canada, and the Union of Soviet Socialist Republics were used. Height-dependent differences between the measurement systems are presented for the temperature and humidity data. Comparisons were made between the U.S.S.R. winds derived from radar tracking, and the U.S. winds derived from radar, VLF, and OMEGA tracking. Means and standard deviations of the wind U and V component differences are computed for different averaging depths. GRA

N77-25747# Louisiana State Univ., Baton Rouge.
ATMOSPHERIC DISPERSION CHARACTERISTICS IN THE LOUISIANA COASTAL ZONE
S. A. Hsu Nov. 1976 32 p refs Sponsored in part by ONR
(PB-264808/7; LSU-T-76-011(t); NOAA-77012808) Avail: NTIS HC A03/MF A01 CSCL 04B

Atmospheric dispersion characteristics in the coastal zone are studied. Physical processes of air, sea, and land which combine at the shoreline to create motions on many scales which differ in important respects from processes over land or over water are reviewed. Synoptic-scale characteristics indicate that the coastal zone is superior to areas farther inland for dispersing pollutants. However, mesoscale and microscale studies reveal that diurnal circulation of land-breeze and sea-breeze systems and the development of an internal boundary layer because of aerodynamic roughness changes across the shoreline may actually increase pollution concentration in the nearshore region. GRA

N77-25748# Army Electronic Techniques, Inc., Fort Collins, Colo.
AUTOMATIC ENVIRONMENTAL SURFACE OBSERVATION PLATFORMS (AESOP) FOR THE HIGH PLAINS EXPERIMENT (HIPLEX) Final Report, May 1976 - Jan. 1977
G. R. Price and V. R. Scheetz Jan. 1977 12 p
(Contract DI-6-07-DR-20030)
(PB-263861/7) Avail: NTIS HC A02/MF A01 CSCL 04B

In order to provide near real time meteorological data from remote locations, developmental work was performed interfacing standard meteorological sensors to a satellite data collection platform. Geostationary Operational Environmental Satellite (GOES) Convertible Data Collection Platforms (CDCP) were converted for use as Automatic Environmental Surface Observation Platforms (AESOP). Three self contained stations were constructed which provide for automatic measuring and transmission of data via satellite for precipitation, temperature, relative humidity, wind speed, wind direction and pressure. GRA

N77-25749# National Center for Atmospheric Research, Boulder, Colo.
NCAR GENERAL CIRCULATION MODEL (GCM) HISTORY TAPE FORMATS AND ANOMALIES
Jordan T. Hastings and Ann D. Cowley Nov. 1976 47 p refs
(Contract NSF C-760)
(PB-263559/7; NCAR-TN-117/IA) Avail: NTIS HC A03/MF A02 CSCL 04B

The basic format of history tapes produced by the National Center for Atmospheric Research General Circulation Model (GCM) is described. Departures from the basic format for various versions of the model are discussed. Also, procedures for accessing the data contained on the tapes are presented. GRA

N77-25750# Aerometric Research, Inc., Goleta, Calif.
COLORADO RIVER BASIN PILOT PROJECT. EXECUTIVE

SUMMARY OF COMPREHENSIVE EVALUATION Final Report, 1970 - 1975
Robert D. Elliott, Russell W. Shaffer, Arnold Court (California State Univ., Northridge), and Jack F. Hannaford (Sierra Hydrotech, Placerville, Calif.) Dec. 1976 24 p
(Contract DI-14-06-D-7332)
(PB-264000/1; ARI-76-1) Avail: NTIS HC A02/MF A01 CSCL 04B

The physical concepts of weather modification potential, and the practical weather modification potential for an operations program, as carried out in the Colorado River Basin Pilot Project during the five winters of 1970-71 through 1974-75, were tested. Nucleant dispersion was investigated based on wind flow and precipitation, and rawinsonde data that is essentially diagnostic in character, and surface runoff related to precipitation were analyzed. Detailed analyses of precipitation and other records for all five years of the pilot project operation were carried out.
GRA

N77-25751# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
AN EVALUATION OF CLOUD FACTORS FOR ESTIMATING INSOLATION OVER THE OCEAN
R. K. Reed Sep. 1976 26 p refs
(PB-264174/4; NOAA-TM-ERL-PMEL-8; NOAA-77012401) Avail: NTIS HC A03/MF A01 CSCL 04B

Observations at three coastal sites are used to derive a cloud factor for the computation of insolation at sea. The factor is 1 - 0.62C + 0.0019 alpha, where C is cloud cover in tenths and alpha is noon solar altitude. This relation is also valid for 125 days of recent measurements over the eastern North Pacific Ocean. The relation can be used to estimate monthly oceanic insolation with a random error less than plus or minus 10%. Most previous cloud factors are inappropriate for a number of reasons: (1) relations derived at inland terrestrial locations are not valid at sea; (2) data were grouped without regard to season (solar altitude); and (3) erroneous clear-sky formulas were used. Lumb's (1964) formulas are valid, but their use places high demands on the quality of cloud observations. If cloud cover is estimated from satellite photographs, the amount should be increased by about 0.2 to give agreement with visual estimates on which the above cloud factor is based. GRA

N77-25752# RAND Corp., Santa Monica, Calif.
RAND/ARPA CLIMATE DYNAMICS RESEARCH: EXECUTIVE SUMMARY Final Report, 1969 - 1975
W. L. Gates Jan. 1977 31 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189)
(AD-A035328; R-2015-ARPA) Avail: NTIS HC A03/MF A01 CSCL 04/2

The history of the Rand/ARPA Dynamics of Climate Project is briefly reviewed, and an overview is given of the project's principal research activities, including significant accomplishments in the areas of atmospheric and oceanic modeling, climatic experimentation and analysis, assembly of climatic data, and programming and use of the Illiac-IV computer. A preliminary assessment is made of future research needs. Author (GRA)

N77-25753# Naval Postgraduate School, Monterey, Calif.
STUDY OF MONSOON CIRCULATION WITH STEADY AND FLUCTUATION HEATING M.S. Thesis
Richard Joseph Pentimonti Dec. 1976 69 p refs
(AD-A035891) Avail: NTIS HC A04/MF A01 CSCL 04/2

In a study of the planetary-scale vorticity budget of the northern summer monsoon, Holton and Colton (1972) found that a strong vorticity sink is needed to balance the generation by horizontal divergence at 200 mb. In this work we use numerical experiments to examine the hypothesis that the fluctuation of divergence forcing as observed by several studies serves as this sink. A 3-level numerical model is used with the thermal forcing specified by the horizontal divergence distribution observed by Krishnamurti (1971). Two experiments are carried out, one with heating steady in time and the other fluctuating in time with a period of 10 days. The time-mean fields of the quasi-steady state solution in both experiments show a significant westward phase shift of the Tibetan high, thus the fluctuation of heating cannot be a sufficient sink. On the other hand, the positions of the simulated tropical upper topospheric troughs agree quite well with those observed. This suggests that damping due to cumulus transport is more likely to account for the vorticity sink. Transient wave activities are also found at the upper level in both experiments. They appear to be drawing energy from the planetary-scale flow and could serve as a vorticity sink. These waves are most active in the fluctuating heating case, suggesting that local barotropic instability at upper levels may be more important than that implied by the time-mean wind.
Author (GRA)

N77-25754# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SUPPRESSION OF ICE FOG FROM COOLING PONDS
Terry McFadden Nov. 1976 89 p refs
(AD-A035322; CRREL-76-43) Avail: NTIS HC A05/MF A01 CSCL 04/2

Ice fog generated at the Eielson AFB power plant cooling pond contributes heavily to the total ice fog problem on the base. Several methods for ice fog suppression were studied and two techniques were tested experimentally. Experiments were also conducted to determine the magnitude of the various modes of heat transfer within the pond's microclimate. Values of evaporative and radiative heat loss during ice fog are presented. Ice cover is shown to be an effective ice fog suppression technique. Monomolecular films are also shown to be effective and offer some unique advantages, such as ease of application and low overall cost. The heat normally lost to evaporation must be dissipated by other means during suppression. With the ice cover technique, this is accomplished by melting the ice cover. During suppression with monomolecular films, the heat must be dissipated by increasing radiative and convective losses. The simplicity of application of monomolecular films, along with their lower cost, combine to make this technique attractive; however, the lower pond temperatures and increased suppression effectiveness weigh heavily in favor of the ice-cover technique.
GRA

N77-25755# National Severe Storms Lab., Norman, Okla.
EVALUATION OF A REMOTE WEATHER RADAR DISPLAY. VOLUME 2: COMPUTER APPLICATIONS FOR STORM TRACKING AND WARNING, PHASE 2 Final Report, May 1975 - Dec. 1976
W. David Zittel Dec. 1976 129 p refs
(Contract DOT-FA74WAI-440)
(AD-A035034; FAA-RD-75-60-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 04/2

Tests with a remote radar display using R, theta coordinates had demonstrated the feasibility of presenting timely warnings for areas in severe storm paths graphically. Mathematical derivations and three case studies utilizing operationally oriented software are presented with suggestions for future work. This research is divided in two parts. Volume I describes the installation of equipment, training of FSS briefers in operation and interpretation, and documentation of data transmitted during the tests. Volume II summarizes research efforts at NSSL to computerize further processing of the displayed data for rapid isolation and tracking of selected storms. Author (GRA)

N77-25756# Air Force Geophysics Lab., Hanscom AFB, Mass.
A PROPOSED PROCEDURE FOR DIAGNOSIS AND IMPROVEMENT OF DYNAMICAL PREDICTION MODELS
Chien-Hsiung Yang 13 Apr. 1976 32 p refs
(AF Proj. 8604)
(AD-A035822; AFGL-TR-76-0079; AFGL-ERP-556) Avail: NTIS HC A03/MF A01 CSCL 04/2

This report lays a logical foundation on which deficiencies of dynamical prediction models can be defined and dealt with on a rational basis. Measures of the quality of performance of dynamical prediction models are suggested, and a procedure with which deficiencies of the models can be diagnosed is proposed. A sample study is used to illustrate the use of the proposed procedure, and the results of the study are presented.
Author (GRA)

N77-25757# National Center for Atmospheric Research, Boulder, Colo.
A COMPREHENSIVE PARAMETERIZATION OF THE ATMOSPHERIC BOUNDARY LAYER FOR GENERAL

CIRCULATION MODELS
Robert Benoit 1976 298 p refs
(Contract NSF C-760)
(PB-264540/6; NCAR-CT-39) Avail: NTIS HC A13/MF A01 CSCL 04B

Over land, surface characteristics like temperature, humidity, snow cover depth, soil moisture and ground conduction are calculated. Examination of the new time series indicates a good realism in the simulated weather near the ground. Comparison with a control version reveals that most simulated quantities remain similar; the most important changes are a reduction of the 1.5 km temperature by up to 4C and a decrease of the subtropical precipitation rates by about 1/3. GRA

N77-25758# National Weather Service, Salt Lake City, Utah.
COOL INFLOW AS A WEAKENING INFLUENCE ON EASTERN PACIFIC TROPICAL CYCLONES
William J. Denney Dec. 1976 12 p refs
(PB-264655/2; NOAA-TM-NWS-WR-110; NOAA-77012802)
Avail: NTIS HC A02/MF A01 CSCL 04B

Relevant research reports are reviewed briefly. They are the basis for concluding that the possibility of cool inflow should be considered regularly in making Eastern Pacific hurricane intensity forecasts. Greater inflow into the right side of a moving storm has special significance for Eastern Pacific hurricane intensity changes. The areal extent of the storm's circulation is another important factor in determining the amount of cool inflow. Satellite pictures reveal much about the volume of air rising in a hurricane's central chimney and, therefore, of the cyclone's intensity. Further application of satellite information and a computer program could be the way to improved intensity forecasts. GRA

N77-25759# Naval Electronics Lab. Center, San Diego, Calif.
FOG RELATED TO SANTA ANA CONDITIONS IN SOUTHERN CALIFORNIA. MULTISENSOR OBSERVATIONS OF FOG AND MESOSCALE DATA PROVIDE ENVIDENCE THAT THE FORMATION AND MOVEMENT OF THE FOG IS CONTROLLED BY MESOSCALE LOW-PRESSURE EDDIES AND TROUGHS Research Report, Jan. 1974 - Dec. 1975
V. R. Noonkester and A. G. C. LeLogue 5 Nov. 1976 72 p refs
(WR0330200)
(AD-A035946; NELC-TR-2000) Avail: NTIS HC A04/MF A01 CSCL 04/2

Many fog events have been observed at the coast of San Diego during the weakening of Santa Ana conditions in Southern California. The events have been observed by remote 'eg, FM-CW radar and acoustic echosounder' and direct eg, radiosonder atmospheric sensors. The sensor observations and analysis of mesoscale data provide evidence that the formation and movement of Santa Ana-related fog is controlled by mesoscale low-pressure eddies and troughs. The fog is always capped by an inversion. Author (GRA)

N77-25760# Missouri Univ., Rolla. Dept. of Mechanical and Aerospace Engineering.
A SYSTEMS STUDY OF MARINE FOG SITUATIONS Final Report, 1 Oct. 1972 - 31 Dec. 1976
Shen C. Lee Feb. 1977 93 p refs
(Contracts N00014-69-A-0140-0006; N00014-75-C-0180)
(AD-A037500; Rept-72-76-0180) Avail: NTIS HC A05/MF A01 CSCL 04/2

This systems study of marine fog considers the dynamical interaction between the synoptical variations of meteorology and the microphysical phenomena in cloud physics. The resulting numerical program simulates the transport of heat, mass, and momentum in the atmospheric boundary layer where condensation/evaporation, thermal radiation, collision coalescence, and turbulent advection take place. Although this program is fairly complete, experimental data of the moisture supply process affected by turbulent winds at the air-sea interface are needed to establish a realistic model for systems analysis. When available field data are compared to predicted fog situations, it is found that the boundary layer model can qualitatively simulate fog situations over an open ocean, but the accurate prediction of a fog event at a specific time and place requires a working knowledge of the moisture supply process occasioned by air-wave interactions. Fog situations occur on the lee side of some topographical obstructions. The wind patterns associated with this type of fog generally have different directions with respect to the prevailing wind. A hypothesis is being formulated to explain such situations on the basis of recirculating flows. Some strange fog conditions have been logically explained by this hypothesis. GRA

N77-25761# Air Force Environmental Technical Applications Center, Scott AFB, Ill.
MODEL OUTPUT STATISTICS FORECAST GUIDANCE
Harry Hughes Sep. 1976 16 p refs
(AD-A037148; USAFETAC-TN-76-3) Avail: NTIS HC A02/MF A01 CSCL 04/2

This publication describes data in the National Weather Services's Model Output Statistics Final Forecast Guidance teletype bulletins. It is intended to serve as a comprehensive guide to the interpretation and use of the forecast bulletins by AWS forecasting units. Author (GRA)

N77-25762# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12811A LANCE MISSILE NUMBER 3206, ROUND NUMBER 284 ACT (23 JULY 1976)
Jul. 1976 39 p
(DA Proj. 1T6-65702-D-127)
(AD-A037662; DR-922) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12811A Lance, Missile Number 3206, Round Number 284 ACT, are presented in tabular form. Author (GRA)

N77-25763# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12814A LANCE MISSILE NUMBER 2714, ROUND NUMBER 288 AST Meteorological Data Report
Sep. 1976 48 p
(AD-A037695; DR-926) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12814A Lance, Missile Number 2714, Round Number 288 AST, are presented in tabular form. Author (GRA)

N77-25764# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12814A LANCE MISSILE NUMBER 3932, ROUND NUMBER 290 RST (7 OCTOBER 1976)
Oct. 1976 37 p
(AD-A037696; ECOM-DR-928) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12814A Lance, Missile Number 3932, Round Number 290 RST, are presented in tabular form. Author (GRA)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-25765# Materials Research Labs., Maribyrnong (Australia).
A MANUAL OF THE PRINCIPAL AUSTRALIAN MARINE FOULING ORGANISMS
G. R. Russ and L. V. Wake Nov. 1975 46 p refs
(Rept-644) Avail: NTIS HC A03/MF A01

A manual has been compiled to provide a guide for the identification of marine fouling species by parties who are interested but not specialists in biological taxonomy. It is mainly intended as a guide during onsite inspection of fouling by dockyard officers and other interested personnel. Descriptions and photographic plates of the 50 most commonly observed macrofouling species have been included together with electron micrographs of some of the more prevalent microfouling species. It is hoped that the quality of the prints and the descriptions of the taxonomic features will permit identification of the fouling species. Author

N77-25766# World Meteorological Organization, Geneva (Switzerland).
INTEGRATED GLOBAL OCEAN STATION SYSTEM. GENERAL PLAN AND IMPLEMENTATION PROGRAMME; 1977 - 1982
Jan. 1977 42 p refs
(WMO-466; T-Ser-16; ISBN-92-63-10466-2) Avail: NTIS HC A03/MF A01; WMO; Geneva

The purpose, principles, expected benefits, and elements of the Integrated Global Ocean Station System (IGOSS) are reviewed followed by a summary of the relation of IGOSS to other international programs and organizations. The elements of the observing system, the telecommunication arrangements, the data processing and services system and the data archiving and exchange system are all described. ESA

N77-25767# American Water Resources Association, Washington, D. C.
THE FUTURE OF CHESAPEAKE BAY
15 Apr. 1976 136 p Symp. proc. held at Arlington, Va., 15 Apr. 1976
(PB-263457/4; W77-04203) Avail: NTIS HC A07/MF A01 CSCL 13B

Contents: The dynamics of Chesapeake Bay; channelization and shipping; ports--Baltimore in particular; shore erosion and wetlands; pollution; ecology; wrap-up. GRA

N77-25768# Naval Postgraduate School, Monterey, Calif.
SOME OBSERVATIONS OF OCEAN THERMAL RESPONSE TO TYPHOON PASSAGE M.S. Thesis
Benjamin Lewis Holt, Jr. Dec. 1976 42 p refs
(AD-A035888) Avail: NTIS HC A03/MF A01 CSCL 04/2

The fact that typhoons cause a cooling of the upper oceanic layers during their passage is well documented. This case study establishes the magnitude of this cooling for 17 western Pacific super-typhoons during the period 1968 to 1972. Digitized bathythermography (BT) records for the typhoons were screened to acquire points before and after typhoon passage that met selection criteria. The selected BT records were then assigned a weight that reflected the number of hours before or after the typhoon passed its closest point of approach (CPA). The resulting data file for the 17 typhoons was analyzed using several techniques. It was found that there is a positive correlation between the magnitude of mixed-layer cooling and the distance from the typhoon path, as well as with wind velocity at the BT site. Mean mixed-layer cooling near the storm path ranged from .70 to 2.0 C with a maximum cooling of 4.8 C. At the outer reaches of the storm's influence 300 mi the mean mixed-layer cooling range was -.09 C to .36 C. the results of the analysis compare favorably with single storm analyses in the Atlantic and a 14 storm analysis in the Pacific. Mixed-layer depth information was subjected to the same analysis as the mixed-layer cooling but the results were inconclusive. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-25769* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROCESS FOR CONTROL OF CELL DIVISION Patent
Clarence D. Cone, Jr., inventor (to NASA) Issued 19 Apr. 1977 10 p Filed 17 Oct. 1975 Continuation of abandoned US Patent Appl. SN-314656 and US Patent Appl. SN125235, filed 13 Dec. 1972 and 17 Mar. 1971
(NASA-Case-LAR-10773-3; US-Patent-4,018,649; US-Patent-Appl-SN-623238; US-Patent-Class-195-1.8; US-Patent-Appl-SN-314656; US-Patent-Appl-SN-125235) Avail: US Patent Office CSCL 06C

A method of controlling mitosis of biological cells was developed, which involved inducing a change in the intracellular ionic hierarchy accompanying the cellular electrical transmembrane potential difference (Esubm) of the cells. The ionic hierarchy may be varied by imposing changes on the relative concentrations of Na(+), K(+) and Cl(-), or by directly imposing changes in the physical Esubm level across the cell surface. NASA

N77-25770# Oak Ridge National Lab., Tenn.
PARAMETRIC STUDY AND PRELIMINARY EVALUATION OF REVERSE OSMOSIS FOR SEAWATER DESALINATION
P. Glueckstern, S. A. Reed, and J. V. Wilson Nov. 1976 51 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5231) Avail: NTIS HC A04/MF A01

One- and two-stage reverse osmosis (RO) systems for seawater desalination was studied with the aid of a recently developed computer program for optimization of RO systems. Membrane manufacturer's performance data and predicted cost data were applied. A preliminary evaluation of the economics of RO for seawater desalination was made based on these data and other equipment and operating costs considered. Plant capacities in the range of 1 to 12.5 Mgd were considered and compared economically with the current most common multistage flash distillation process at different energy price levels. ERA

N77-25771# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
ELECTRON MICROSCOPE INVESTIGATIONS OF THE EFFECT OF FIVE-DAY WEIGHTLESSNESS SIMULATION ON THE DEVELOPMENT OF THE FROG EMBRYO (RANA TEMPORARIA) VESTIBULAR ORGAN
Juergen Neubert, Wolfgang Briegleb, and Albrecht Schatz 7 Dec. 1976 37 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-397)
(DLR-FB-76-66) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, DM 17

Results of experiments with fertilized frog eggs which developed under conditions of five days simulated weightlessness are described. The tests were designed to determine if there is any effect on the ability of the eggs to divide normally and on subsequent differentiation especially of the gravity receptor located in the vestibular organ. The submicroscopic structure of the macula utriculi (sensory epithelium) was compared between test and control animals. No abnormalities could be detected in the morphological structure. The results were compared with those of comparable experiments at zero g (Soyuz 10, Biosatellite 2, Gemini 8 and 12) and very good agreement was noted. Indications are given for future experimental steps to obtain more clarity concerning the function of the gravity organ under conditions of simulated and real weightlessness. These experiments should be histo- and cytochemical ones. Author (ESA)

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-25772* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
MAGNETIC ELECTRICAL CONNECTORS FOR BIOMEDICAL PERCUTANEOUS IMPLANTS Patent
Lester J. Owens, inventor (to NASA) Issued 31 May 1977 5 p Filed 30 Jul. 1976 Supersedes N77-15617 (15 - 06, p 0789)
(NASA-Case-KSC-11030-1; US-Patent-4,025,964; US-Patent-Appl-SN-709849; US-Patent-Class-3-1; US-Patent-Class-128-1R; US-Patent-Class-339,12R) Avail: US Patent Office CSCL 06B

A biomedical percutaneous connector is described which includes a socket having an enlarged disk shaped base portion for being implanted below the patient's skin and cylindrical portion which is integral with the base portion and extends outwardly of the skin. A conical recess in an upper end of the cylindrical portion has a magnet located in the base. Inclined conductive strips are carried on an upper end of the cylindrical portion to which electrical conductors are attached and extend into the patient's body. A complementary shaped plug which also has electrical contacts provided thereon is adapted to fit within the conical recess of the socket. The plug is held in the socket by magnetic force. Official Gazette of the U.S. Patent Office

N77-25773*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 166)
Apr. 1977 74 p
(NASA-SP-7011(166)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 212 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1977. Author

N77-25774*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 167)
May 1977 82 p refs
(NASA-SP-7011(167)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 235 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1977. Author

N77-25775*# IIT Research Inst., Chicago, Ill. Techno/Economic Study Group.
MARKET STUDY: WHOLE BLOOD ANALYZER
[1977] 113 p
(Contract NASw-2837)
(NASA-CR-153254) Avail: NTIS HC A06/MF A01 CSCL 06D

A market survey was conducted to develop findings relative to the commercialization potential and key market factors of the whole blood analyzer which is being developed in conjunction with NASA's Space Shuttle Medical System. Author

N77-25776*# California Univ., Davis.
MODIFICATION OF OS CALCIS BONE MINERAL PROFILES DURING BEDREST
John Max Vogel 1977 12 p refs
(Contract NAS9-13589)
(NASA-CR-151421) Avail: NTIS HC A02/MF A01 CSCL 06S

The mineral content of the left central os calcis was determined using the photon absorptiometric technique modified for the space missions to permit area scanning, and was compared with total body calcium balance changes. The instrument consists of a rectilinear scanner that is programmed by a specially designed control module to move a low energy X-ray emitting radionuclide placed in opposition to a detector to scan the foot which is places between them. The foot is placed in a plexiglas box filled with water to provide tissue equivalence and to compensate for irregularities in thickness of tissue cover that surrounds the bone. The mineral content is obtained from basic attenuation equation. Author

N77-25777# Interuniversitair Reactor Instituut, Delft (Netherlands).
CALCULATION OF THE DEPOSITION OF POLYDISPERSE AEROSOLS IN THE GLASS MODELS OF THE UPPER HUMAN AIRWAYS. DESCRIPTION OF THE COMPUTER PROGRAM
G. A. Ferron Sep. 1976 14 p refs
(IRI-190-76-02) Avail: NTIS HC A02/MF A01

The deposition was calculated with the solutions for deposition by sedimentation and diffusion from a laminar airflow in the circular cylindrical tubes of Thomas, Gromley, and Kennedy equations. The polydispersity of the aerosol is taken into account in the computer program. The results obtained using this computer program are compared with the experimental deposition measured in the glass model. ESA

N77-25778# Medical Physics Inst. Utrecht (Netherlands).
[RESEARCH ACTIVITIES IN APPLICATION OF PHYSICS AND ENGINEERING TO MEDICAL SCIENCE AND PROBLEMS] Progress Report
B. VanEijnsbergen, ed. and F. L. LopesdaSilva, ed. Dec. 1976 210 p refs
(TNO-MFI-PR-5) Avail: NTIS HC A10/MF A01

Activities are reported in the form of short articles. The fields of interest dealt with are: development of aids and appliances for the bodily handicapped, cardiovascular physics, brain research, cybernetics, physiological signal processing, medical instrumentation, and lung mechanics. ESA

N77-25779# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPUTER IDENTIFICATION OF PREMATURE VENTRICULAR CONTRACTIONS IN ELECTROCARDIOGRAMS M.S. Thesis
John P. DiTucci Dec. 1976 84 p refs
(AD-A035285; GE/EE/76-22) Avail: NTIS HC A05/MF A01 CSCL 06/5

Algorithms to locate and identify premature ventricular contractions (PVC's) in single lead electrocardiograms are developed and evaluated on twelve 100 second electrocardiogram recordings. The location algorithms detect waveforms which are either QRS complexes or PVC's. The identification algorithms are then used to classify the waveforms as QRS complexes, PVC's, or premature beats. QRS and PVC classification is based on the evaluation of linear combinations of low frequency Walsh transform coefficients for each located waveform. Premature beat classification is based on a rhythm analysis. Of 1397 QRS complexes evaluated, 1386 or 99.21% were classified correctly. GRA

N77-25780# School of Aerospace Medicine, Brooks AFB, Tex.
EFFECTS OF CONTAMINATED SUPPLY AIR ON PURITY OF BREATHING OXYGEN GENERATED BY FLUOMINE Progress Report, Jun. 1975 - Jan. 1976
Leonard J. Luskus and Herman J. Kilian Dec. 1976 14 p refs
(AF Proj. 7930)
(AD-A035745; SAM-TR-76-42) Avail: NTIS HC A02/MF A01 CSCL 06/11

Air used to supply oxygen to the fluomine bed of a model Open Loop Oxygen Generating System (OLOGS) was adulterated with various contaminants to study their effect on performance of the fluomine chemical and purity of the oxygen product. Contaminants investigated were water, carbon dioxide, carbon monoxide, benzene, n-heptane, ethanol, acetone, acetaldehyde, Freon 12, and nitrogen dioxide. No deleterious effect on fluomine chemical was observed at the contaminant concentration used during short-term testing. Oxygen purity was affected to various extent by the different contaminants. Carbon monoxide, carbon dioxide, and nitrogen dioxide did not accumulate in the oxygen product. Water concentrated to 5%. The organic contaminants accumulated up to 8 times their concentration in the supply air. Nitrogen dioxide was the only contaminant irreversibly absorbed by the fluomine. Odor was present in the oxygen product when odorous organic contaminants were present in the supply air. The authors concluded that the fluomine beds need protection from excessive water, N-oxide and organic contamination to avoid oxygen of unacceptable quality and possible accelerated fluomine degradation. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N77-25781# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Instrumentierung und Anthropotechnik.
PRACTICAL UTILITY OF CRITICAL FLICKER FUSION FREQUENCY MEASUREMENTS TO ASSESSMENT OF MENTAL WORKLOAD
Fred Volker Schick 14 Dec. 1976 39 p refs In GERMAN; ENGLISH summary Prepared jointly with Tech. Univ. Brunswick Report will also be announced as translation (ESA-TT-398)
(DLR-FB-76-67) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, DM 19.10

Two experiments were conducted to evaluate the utility of an advanced measuring device, coupled with a practicable measurement procedure, with respect to reliable and valid assessment of mental workload by measuring critical flicker fusion frequency (CFF). In the first experiment, basic variability of CFF

scores, obtained from 11 subjects under nonworkload conditions, was studied. Error of measurement as well as physical and psychical interference variables were discussed to be sources of the large oscillations actually observed from data. It was found necessary to modify the measurement procedure. In the second experiment 10 subjects' CFF thresholds were examined. Statistical analysis revealed generally low reliability coefficients. Also thresholds failed to discriminate between low workload and high workload treatments. Results suggest that the magnitude of threshold's fluctuations due to individual physical and psychical interferences exceed threshold's alterations due to treatments.
Author (ESA)

N77-25782# Naval Postgraduate School, Monterey, Calif.
THE DESIGN, CONSTRUCTION, AND IMPLEMENTATION OF A SIMULATED PILOT'S TASK TO BE USED IN THE STUDY OF THE EFFECTS OF EEG BIOFEEDBACK M.S. Thesis
Douglas Pierce Ayers Sep. 1976 56 p refs
(AD-A035884) Avail: NTIS HC A04/MF A01 CSCL 06/5

A brief history of the EEG and a physiological explanation of the possible causes of EEG waveforms is given. A highly reliable simulated pilot's tasking system is designed and explained in detail. An analog circuit to produce a voltage equal to the square root of the sum of two input voltages squared is designed to be used as a measure of effectiveness of EEG biofeedback. A discussion of present and future data analysis programs is presented. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-25783*# IIT Research Inst., Chicago, Ill. Techno/Economic Studies Group.
MARKET STUDY: 3-D EYETRACKER
20 May 1977 82 p refs
(Contract NASw-2837; IITRI Proj. H6046-H28)
(NASA-CR-153253) Avail: NTIS HC A05/MF A01 CSCL 05H

A market study of a proposed version of a 3-D eyetracker for initial use at NASA's Ames Research Center was made. The commercialization potential of a simplified, less expensive 3-D eyetracker was ascertained. Primary focus on present and potential users of eyetrackers, as well as present and potential manufacturers has provided an effective means of analyzing the prospects for commercialization. Author

N77-25784*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACESUIT TORSO CLOSURE Patent Application
Bruce W. Webbon and Hubert C. Vykukal, inventors (to NASA) Filed 23 Mar. 1977 17 p
(NASA-Case-ARC-11100-1; US-Patent-Appl-SN-780569) Avail: NTIS HC A02/MF A01 CSCL 06Q

A simple, economical and reliable entry closure is described for joining opposite halves of a torso section for a pressure suit in a manner which simplifies self-donning. A single coupling joins coaxially aligned, axially separable, tubular segments of a hard spacesuit along an angulated zone of separation, adapted to be mated in an hermetrically sealing relation. A C section clamp secures the members in their mated relationship. NASA

N77-25785*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
RESEARCH ON INTEGRATION OF VISUAL AND MOTION CUES FOR FLIGHT SIMULATION AND RIDE QUALITY INVESTIGATION Final Report, Jun. 1972 - Feb 1977
L. R. Young, C. M. Oman, and R. E. Curry 15 Jun. 1977 84 p refs
(Grant NGR-22-009-701)
(NASA-CR-153249) Avail: NTIS HC A05/MF A01 CSCL 05H

Vestibular perception and integration of several sensory inputs in simulation were studied. The relationship between tilt sensation induced by moving fields and those produced by actual body tilt is discussed. Linearvection studies were included and the application of the vestibular model for perception of orientation based on motion cues is presented. Other areas of examination includes visual cues in approach to landing, and a comparison of linear and nonlinear wash out filters using a model of the human vestibular system is given. B.B.

N77-25786*# Essex Corp., Huntsville, Ala.
EARTH ORBITAL TELEOPERATOR MOBILITY SYSTEM EVALUATION PROGRAM
Ronald G. Brye, Nicholas L. Shields, Jr., and Mark Kirkpatrick, III 28 Jan. 1977 34 p refs
(Contract NAS8-31848)
(NASA-CR-150285; H-77-4; Rept-1) Avail: NTIS HC A03/MF A01 CSCL 05H

The proximity translation and final docking of the space teleoperator evaluation vehicle (STEV) with large mass and small mass satellites was studied. Operations that may be performed by the STEV during the shuttle experiments are approximated.
Author

N77-25787*# Essex Corp., Huntsville, Ala.
EARTH ORBITAL TELEOPERATOR MANIPULATOR SYSTEM EVALUATION PROGRAM
Ronald G. Brye, P. Norman Frederick, Mark Kirkpatrick, III, and Nicholas L. Shields, Jr. 29 Jan. 1977 59 p refs
(Contract NAS8-31848)
(NASA-CR-150286; H-77-2; Rept-4) Avail: NTIS HC A04/MF A01 CSCL 05H

The operator's ability to perform five manipulator tip movements while using monoptic and stereoptic video systems was assessed. Test data obtained were compared with previous results to determine the impact of camera placement and stereoptic viewing on manipulator system performance. The tests were performed using the NASA MSFC extendible stiff arm Manipulator and an analog joystick controller. Two basic manipulator tasks were utilized. The minimum position change test required the operator to move the manipulator arm to touch a target contract. The dexterity test required removal and replacement of pegs. Author

N77-25788*# Essex Corp., Huntsville, Ala.
EARTH ORBITAL TELEOPERATOR VISUAL SYSTEM EVALUATION PROGRAM
P. Norman Frederick, Nicholas L. Shields, Jr., and Mark Kirkpatrick, III 28 Jan. 1977 120 p refs
(Contract NAS8-31848)
(NASA-CR-150287; H-77-3; Rept-5) Avail: NTIS HC A06/MF A01 CSCL 05H

Visual system parameters and stereoptic television component geometries were evaluated for optimum viewing. The accuracy of operator range estimation using a Fresnell stereo television system with a three dimensional cursor was examined. An operator's ability to align three dimensional targets using vidicon tube and solid state television cameras as part of a Fresnell stereoptic system was evaluated. An operator's ability to discriminate between varied color samples viewed with a color television system was determined. Author

N77-25789*# Life Systems, Inc., Cleveland, Ohio.
EVALUATION OF A SPACECRAFT NITROGEN GENERATOR Annual Report
R. D. Marshall and W. J. Knebel Jan. 1977 41 p refs
(Contract NAS2-8732)
(NASA-CR-151983; LSI-ER-251-10-2; AR-2) Avail: NTIS HC A03/MF A01 CSCL 06K

An experiment was completed to demonstrate that low ammonia concentrations in the product nitrogen stream are possible using the staging concept. Mixtures of nitrogen, hydrogen and ammonia were fed into a temperature controlled packed bed ammonia dissociator. An ammonia concentration of 1.03% in the feed stream was reduced to less than 50 ppm at temperatures greater than or equal to 777K. The actual inlet ammonia concentration to the final nitrogen generation module ammonia dissociation stage was only 0.09%. Author

N77-25790# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.

THE EFFECT OF VIRTUAL IMAGE PROJECTION DISTANCE ON THE ACCOMMODATIVE RESPONSE OF THE EYE

Gloria Twine Ehisum and Phyllis E. Morway 4 Feb. 1977 27 p refs

(AD-A036136; NADC-77017-40) Avail: NTIS HC A03/MF A01 CSCL 19/5

Virtual image displays utilize either aircraft mounted or helmet mounted beam splitters, or combining screens. The effect on the accommodative response of the projection distance of the virtual image was measured by photographing the first and fourth Purkinje images of a source. The results indicate possible effect on the accommodation response. Further explanation of the problem is indicated. Author (GRA)

N77-25791# Human Resources Research Organization, Alexandria, Va.

LONG-TERM RETENTION OF FLYING SKILLS: AN ANNOTATED BIBLIOGRAPHY Final Report, 1 May - 15 Sep. 1976

Wallace W. Prophet Oct. 1976 144 p refs

(Contract F44620-76-C-0106)

(AD-A036114; HumRRO-FR-ED(P)-76-36) Avail: NTIS HC A07/MF A01 CSCL 05/9

In support of USAF Saber Wings II study, a survey of the state of behavioral science knowledge with reference to long-term retention of flying skills was conducted. Various literature sources were surveyed, as well as selected agencies and knowledgeable individuals. Abstracts or annotated references are presented for 120 references. Literature is grouped as: flight skill retention studies; non-flight skill retention studies; miscellaneous aviation studies; and literature reviews and references. Abstract length varies from three pages to a single paragraph. An additional 80 references are given as reviewed, but not pertinent.

Author (GRA)

N77-25792# Wayne State Univ., Detroit, Mich. Dept. of Industrial Engineering.

VEHICLE EYE REFERENCING DATA Final Report, Dec. 1975 - Sep. 1976

R. R. Mourant and R. G. Arbogagt Nov. 1976 95 p ref

(Contract DOT-HS-6-01301)

(PB-262821/2) Avail: NTIS HC A05/MF A01 CSCL 13F

Research to determine drivers' eye locations in various vehicles is reviewed. Driver eye position data were collected for fifty subjects as they drove a standard sedan and a van truck. For both vehicle types comparisons were made between data collected in a laboratory buck, a static vehicle, and in a moving vehicle. Eye position data was collected to enable comparisons of the data as a function of vehicle package geometry. In particular, the closeness of the compact car's structure to the driver's body may restrict movement and thus result in smaller eyellipses.

GRA

N77-25793# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE SCALING PROBLEM IN VISUAL PATTERN RECOGNITION M.S. Thesis

Douglas D. Carpenter Dec. 1976 122 p refs

(AD-A035290; GE/EE/76D-17) Avail: NTIS HC A06/MF A01 CSCL 06/4

The human pattern recognition system has been modeled as a system utilizing a low-pass, spatially-filtered, Fourier transform to represent input patterns and stored prototypes. This model is used to infer the existence of possible mechanisms underlying the scale invariant aspect of the human pattern recognition system. Two hypotheses are suggested: scaling (size normalization) of input patterns, or the storage of multiple-prototypes based on size. Experiments are carried out to distinguish between the two mechanisms. It is concluded that both mechanisms are utilized at different levels within the visual process. A revised model is developed to adequately account for the experimental results.

Author (GRA)

N77-25794# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

ANALYSIS OF LANGUAGES FOR MAN-MACHINE VOICE COMMUNICATION Interim Report Ph.D. Thesis - Stanford Univ.

Robert Gary Goodman Sep. 1976 173 p refs

(Contract F44620-73-C-0074; ARPA Order 2446)

(AD-A035564; AFOSR-77-0055TR) Avail: NTIS HC A08/MF A01 CSCL 05/7

This dissertation describes a general model for the analysis of languages for man-machine communication. It is the first known study of ambiguity at all levels of recognition and represents the best analytical tool, to date, for the design of languages. The model unifies the concepts of ambiguity and restriction done by expressing each as a branching factor-a notion which is easily understood and visualized. Ambiguity increases the branching factor while restriction reduces it. Using branching factor has the advantage that an effective search space size may be computed for any language. Further, since ambiguity and syntactic restriction are expressed in a uniform way, the effect of one with respect to the other may be evaluated by considering search space reduction ratios. The model is useful for comparing the relative complexities faced by speech understanding systems. Effective vocabulary size provides a way of measuring the complexity in isolated word recognition while effective search space size measures language complexity. Thus, the performance of 2 systems may be contrasted by using these measures previously, this could be done only if the 2 systems had been tested using the same data, a situation which occurred rarely. GRA

N77-25795# Naval Research Lab., Washington, D. C.

NRL'S CENTRAL ATMOSPHERE MONITOR PROGRAM

F. E. Saalfeld and J. R. Wyatt Dec. 1976 48 p refs

(AD-A035774; NRL-MR-3432) Avail: NTIS HC A03/MF A01 CSCL 13/10

To meet the operational requirement of having submarines remain submerged for periods up to 90 days, it is necessary to have a pure atmosphere for the survivability of the crew. This requires some method for analyzing the submarine atmosphere. The current system under development, CAMS-II, will use a computer-controlled scanning mass, spectrometer. Therefore, any compound that is introduced into the submarine's atmosphere can, in principle, be monitored by only a program change in the computer. CAMS-II also uses an infrared detector to monitor CO. The CAMS-IIB, an integrated life support system, is the last stage of the CAMS program. If CAMS-II is as reliable as CAMS-I, the CAMS-II computer system will be expanded to control the entire life support system of the submarine. For example, in the CAMS-IIB system, when the oxygen concentration decreases the CAMS-IIB computer automatically increases the oxygen concentration of the submarine to the desired level by adjusting the oxygen generator output. Similarly the CAMS-IIB will control the CO2 scrubber, monitor the carbon bed status for contaminant breakthroughs, and adjust the temperature of the CO/H2 catalytic burner. Thus, with the CAMS-IIB system, it will be possible to reduce the crew needed to support the submarine life support system and also to improve the quality of the atmosphere available on the submarine. GRA

N77-25796# Rockwell International Corp., Columbus, Ohio. Aircraft Div.

SEA BASED AIRCRAFT HABITABILITY CRITERIA Technical Report, 17 Aug. - 15 Oct. 1976

James D. Aurand 15 Oct. 1976 58 p refs

(Contract N00600-76-C-1606)

(AD-A035341; NR76H-113) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report defines sea based aircraft habitability criteria including vertical, lateral (horizontal) and roll limits for on-water operations. Heating, ventilation, air conditioning, illumination, and volume limits are also indicated. Representative aircraft on-water motions are indicated and compared to motion sickness limits. No serious habitability limitations were uncovered for the surface following sea based aircrat concept. This report is a supplement to AD A035 344. GRA

N77-25797# Human Engineering Labs., Aberdeen Proving Ground, Md.

A HUMAN FACTORS EVALUATION OF A VERTICAL-SCALE INSTRUMENT DISPLAY SYSTEM FOR THE OV-1D AIRCRAFT Final Report

Harry R. Stowell and Alan M. Poston Jan. 1977 51 p refs (AD-A036050; HEL-TM-4-77) Avail: NTIS HC A04/MF A01 CSCL 01/4

Because of the increased importance of conserving aircraft instrument-panel space, vertical-scale instrument displays are being given greater consideration. In an effort to identify any potential problems associated with vertical-scale instrument displays, a human-factors evaluation was performed on the production prototype of the vertical-scale instrument display for the OV-1D. Some of the factors considered in the investigation include light distribution, spectral analysis, impact on dark adaptation, high-ambient conditions, and night-vision-goggle compatibility. Recommendations have been made with respect to the light distribution and marking sizes. Author (GRA)

N77-25798# Grumman Aerospace Corp., Bethpage, N.Y.
CREWMANS RETENTION SYSTEM FOR PROTECTION AGAINST HIGH SPEED EJECTION UP TO 600 KNOTS Final Engineering Report, Feb. - Oct. 1976
Jerry Guarracino, Stanis Coryell, and Robert Delvecchio Oct. 1976 246 p refs
(Contract N62269-76-C-0082)
(AD-A036898; NADC-76119-40) Avail: NTIS HC A11/MF A01 CSCL 06/19

It can be firmly stated that a real-world problem exists in that crewman are being injured and survival equipment is being damaged during high speed ejections. This report covers the following areas of work conducted to define, investigate, analyze, and select devices to provide crewman protection against the forces of up through a 600 knot open escape seat ejection. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N77-25799*# Stanford Research Inst., Menlo Park, Calif.
METHODOLOGY FOR BACK-CONTAMINATION RISK ASSESSMENT FOR A MARS SAMPLE RETURN MISSION Final Report
M. W. Merkhofer and D. J. Quinn Apr. 1977 121 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954546; SRI Proj. 5534)
(NASA-CR-153251) Avail: NTIS HC A06/MF A01 CSCL 03B

The risk of back-contamination from Mars Surface Sample Return (MSSR) missions is assessed. The methodology is designed to provide an assessment of the probability that a given mission design and strategy will result in accidental release of Martian organisms acquired as a result of MSSR. This is accomplished through the construction of risk models describing the mission risk elements and their impact on back-contamination probability. A conceptual framework is presented for using the risk model to evaluate mission design decisions that require a trade-off between science and planetary protection considerations. Author

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N77-25800# Polish Academy of Sciences, Warsaw.
AN ANALOG FUNCTIONS CHANNEL, TYPE KF-01, FOR STORAGE AND RETRIEVAL OF INFORMATION IN AN ON-LINE SYSTEM, INTO/FROM THE MOMIK 8 B/100 MINICOMPUTER MEMORY [KANAL FUNKCJI ANALOGOWYCH TYP KF-01 DO WPROWADZANIA I WYPROWADZANIA INFORMACJI W SYSTEMIE ON LINE DO/Z PAMIECI MINIKOMPUTERAMOMIK 8B/100]
Krzysztof Mytkowski 1976 83 p refs In POLISH
Avail: Issuing Activity

Polish equipment designed for research work in the field of speech phonetics and acoustics is described. General data concerning storage and retrieval of information in MERA minicomputers, a functional description of equipment based on a block chart, and a special technical description of an analog functions channel (KEA), based on logical and ideal schematic diagrams are given. How the KFA operates and how to use it is discussed alongwith the functioning of individual blocks. Analyses of mistakes and some important calculations are included. Author

N77-25801*# Macrodata Corp., Woodland Hills, Calif.
STUDY OF LIMITATIONS AND ATTRIBUTES OF MICROPROCESSOR TESTING TECHNIQUES Final Report
Richard McCaskill and Wayne E. Sohl 17 Mar. 1977 257 p
(Contract NAS8-31954)
(NASA-CR-150284) Avail: NTIS HC A12/MF A01 CSCL 09B

All microprocessor units have a similar architecture from which a basic test philosophy can be adopted and used to develop an approach to test each module separately in order to verify the functionality of each module within the device using the input/output pins of the device and its instruction set; test for destructive interaction between functional modules; and verify all timing, status information, and interrupt operations of the device. Block and test flow diagrams are given for the 8080, 8008, 2901, 6800, and 1802 microprocessors. Manufacturers are listed and problems encountered in testing the modules are discussed. Test equipment and methods are described. Author

N77-25802# Brookhaven National Lab., Upton, N.Y.
SHARED RANDOM ACCESS MEMORY RESOURCE FOR MULTIPROCESSOR REAL-TIME SYSTEMS
D. G. Dimmler and W. H. Hardy, II Oct. 1976 8 p refs Presented at Nucl. Sci., Scintillation and Semiconductor Counter Symp., New Orleans, 20 Oct. 1976; sponsored by IEEE Submitted for publication
(Contract EY-76-C-02-0016)
(BNL-21884; Conf-761006-19) Avail: NTIS HC A02/MF A01

A shared random-access memory resource is described which is used within real-time data acquisition and control systems with multiprocessor and multibus organizations. Hardware and software aspects are discussed in a specific example where interconnections are done via a UNIBUS. The general applicability of the approach is also discussed. ERA

N77-25803# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
LOW COST DUAL A/D CONVERTER USED AS TERMINAL OF THE HP 2116 B COMPUTER [ECONOMICO DOPPIO CONVERTITORE A/D COME TERMINALE DEL CALCOLATORE HP 2116 B]
P. Cerulli-Irelli Oct. 1976 18 p refs In ITALIAN
(LPS-76-27) HC A02/MF A01

The realization of an 8-bit dual analog to digital converter for use as an HP 2116 B computer terminal is described. The application of the converter in BASIC IOB5 programming language is discussed, and a list of subrountines is given. ESA

N77-25804# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

REAL TIME ACQUISITION AND PREPROCESSING OF DATA FROM THE GRAVITATIONAL WAVE EXPERIMENT [SCHEMA DI ACQUISIZIONE E PREELABORAZIONE IN TEMPO REALE DEI DATI FORNITI DALLO ESPERIMENTO SULLE ONDE GRAVITAZIONALI]

P. Bonifazi Dec. 1976 34 p refs In ITALIAN
(LPS-76-31) Avail: NTIS HC A03/MF A01

A possible scheme for real time acquisition and computer preprocessing is described. The experiment includes a Weber-type cylindrical antenna of 150 cm length and 35 cm diameter operating at cryogenic temperatures. A series of initialization operations and diagnostic controls of the experiment, necessary to run the experiment automatically, are also described. ESA

N77-25805# Naval Underwater Systems Center, Newport, R. I. Combat Systems Control Dept.

OPTIMIZATION TECHNIQUES FOR THE NUSC FORTRAN CROSS-COMPILER

Robert A. Converse 2 Jan. 1977 32 p refs
(NUSC Proj. 635P11)
(AD-A036147; NUSC-TR-5214) Avail: NTIS
HC A03/MF A01 CSCL 09/2

A high-level language permits a programmer to communicate easily with a computer. The machine program that results from the use of a high-level language generally executes slower and requires more of the computer resources than the same program written efficiently in machine language. An optimization pass for the language processor can reduce the execution time and the resource requirements of the resulting program. A machine independent optimization pass that accomplishes such improvements is described in this report. The algorithms that make up the optimization pass include both machine independent general algorithms and a generalization of some machine specific features. The language processor for which optimization is performed is a cross-compiler. Examples are given illustrating the results of the optimization algorithms. Author (GRA)

N77-25806# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.

REGIONAL SEMINAR ON OMNITAB II

David Hogben and Sally T. Peavy Dec. 1976 27 p refs Seminar held at La Paz, Bolivia, 12-25 May 1976
(Grant PASA-TA(CE)-5-71)
(PB-261995/5; NBSIR-76-1176) Avail: NTIS
HC A03/MF A01 CSCL 09B

An AID Regional Seminar on applications of the OMNITAB 2 computing system was conducted in La Paz, Bolivia, from May 11th to May 26th. A Spanish, interactive version of OMNITAB 2 was implemented on the CENACO DEC-10 system computer. From May 17 to 22, lectures were given to thirty participants from five Latin American countries and sessions were held for the participants to gain experience in the use of OMNITAB 2 from terminals. At the begining, the computer was not used; at the end, OMNITAB 2 was used extensively to solve important problems. An international agreement was signed by participants from the Latin American countries to cooperate in the utilization of computers. GRA

N77-25807# California Univ., Los Angeles. Dept. of Computer Science.

A MULTIACCESS MEMORY Ph.D. Thesis

Phillip B. Korff Jul. 1976 216 p refs
(Grant NSF MCS-72-03633-A04)
(PB-262725/5; UCLA-ENG-7607;
NSF/OCA-MCS-7203633-76074) Avail: NTIS
HC A10/MF A01 CSCL 09B

Techniques are described for the realization and implementation of a multiaccess memory. Through simulation and numerical analysis, the performance of the memory, based on response time versus utilization, was predicted for various types of theoretical inputs. A fault tolerant design and the performance of a faulty memory system were established. GRA

N77-25808# Pacific Missile Test Center, Point Mugu, Calif.

COMPUTERIZED ACCOMMODATED PERCENTAGE EVALUATION: REVIEW AND PROSPECTUS

Alvan C. Bittner, Jr. 31 Dec. 1976 15 p refs
(AD-A035205; PMTC-TP-76-46) Avail: NTIS
HC A02/MF A01 CSCL 05/5

This report reviews about a dozen past and current research efforts employing Monte Carlo 'computerized accommodated percentage evaluation' (CAPE) models. The CAPE class of models estimate the effects of imposed limits of the accommodated proportion of a population. Most extensively used in studies of aircraft cockpit and related workplace design, the model has been applied to other areas as well. Four validation studies, five completed application investigations, and three on-going application efforts are described. Prospects for future applications are also briefly discussed. GRA

N77-25809# Ohio State Univ., Columbus. Computer and Information Science Research Center.

THE ARCHITECTURE OF A DATABASE COMPUTER. PART 2: THE DESIGN OF STRUCTURE MEMORY AND ITS RELATED PROCESSORS

David K. Hsiao and Krishnamurthi Kannan Oct. 1976 113 p refs
(Contract N00014-75-C-0573)
(AD-A035178; OSU-CISRC-TR-76-2-Pt-2) Avail: NTIS
HC A06/MF A01 CSCL 09/2

The database computer (DBC) is a specialized back-end computer which is capable of managing data of 10 to the 9th power -10 to the 10th power bytes in size and supporting known data models such as relational, network, hierarchical and attribute-based models. In addition to its intended purpose of handling large databases and interfacing with various data models, the DBC is one of the first database machines which have built-in protection mechanisms for access control and clustering mechanisms for performance enhancement. GRA

N77-25810# Defense Systems Management School, Fort Belvoir, Va.

INTERACTIVE COMPUTER GRAPHICS APPLICATIONS FOR PROGRAM MANAGEMENT

George H. Peroin, Jr. Nov. 1976 39 p refs
(AD-A035158) Avail: NTIS HC A03/MF A01 CSCL 09/2

While the use of interactive graphics is fairly well established in the scientific field, managerial applications are still in an embryonic stage of development. Two reasons for this became apparent. First, there has been a general reluctance on the part of managers, themselves, to become involved in the design of application software. Second, the cost of most computer systems has been too high, in the past, to allow for the acquisition of unproven computer capabilities in the budgets of all but the largest companies. Research results also indicate that the computer industry is placing its emphasis on improvements in hardware technology rather than on software design. Marketing brochures underscore the widespread availability of equipment and a disheartening lack of commercially available business application software. Until management becomes convinced that interactive graphics capabilities can be a practical and economical aid to decision-making and becomes involved in the development of software packages, we will not see rapid and widespread growth in this area. GRA

N77-25811# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.

TREAD/TLOOK. A MULTIPURPOSE COMPUTER ROUTINE FOR INTERPOLATION AND EXTRAPOLATION OF TABULAR DATA

M. J. Caddy 11 Jan. 1977 49 p refs
(AD-A035793; NADC-76366-30) Avail: NTIS
HC A03/MF A01 CSCL 09/2

A general purpose computer code is described which permits a rapid, efficient table look-up of one dependent variable in terms of one, two, or three independent variables. A cubic spline fit is used to interpolate or extrapolate between inputted points. The resulting dependent variable function is smooth and continuous in both first and second derivatives. GRA

N77-25812# Defense Systems Management School, Fort Belvoir, Va.

USE ON AN INTERACTIVE COMPUTER GRAPHICS MODEL IN ARMY PROJECT PLANNING AND CONTROL

Douglas Curtis Seay Oct. 1976 42 p refs
(AD-A036186) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper discusses an interactive computer graphics model which is used by the U.S. Army's PATRIOT Project Office in planning and control functions. This simulative computer networking model, AUTONET, is able to display a variety of standard network analysis reports as well as time and cost frequency distributons(histograms) and indices of criticality (percentage of the time an item was on the critical path) for both paths and activities. One unusual feature of the AUTONET model is the tiered structure of its data base. There must be a summary level network consisting of up to 100 activities each of which may be supported at the second level by networks of up to 100 activities. Similarly there is the capability of supporting each of these second level activities by third level networks if such detail is required. Whenever information is processed at a lower level it is automatically rolled up through the appropriate parent network to the summary network. A discussion is included regarding the advantages and disadvantages of this model's use. Author (GRA)

N77-25813# Naval Postgraduate School, Monterey, Calif.
EMULATION OF THE AN/UYK-7 TACTICAL DATA COMPUTER ON THE BURROUGH'S D-MACHINE M.S. Thesis
Jerry Michael Haggerty and John Michael Hartling Dec. 1976 180 p refs
(AD-A035885) Avail: NTIS HC A09/MF A01 CSCL 09/2

A workable design is presented for emulating the AN/UYK-7 multiprocessing computer system on the Burrough's Interpreter Based System, the DM Machine. The program developed provides for exact execution of the AN/UYK-7 instruction repertoire with the exception of Floating Point, hardware interrupts and IOC Instrunctions. The design allows for future expansion to incorporate these functions. Input/Output is limited to a card reader, line printer and single disk. Various aspects of Emulation, the D Machine, and the AN/UKY-7 are discussed and a detailed User's Manual is provided along with recommendations for modifying the design into a full emulation. Author (GRA)

N77-25814# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EMULATION OF THE PROCESSOR FOR DISTRIBUTED PROCESSOR/MEMORY SYSTEM ON INTEL 3000 MICROPROCESSOR CHIP SET M.S. Thesis
Azhar Maud Dec. 1976 198 p refs
(AD-A035286; GE/EE/76D-34) Avail: NTIS HC A09/MF A01 CSCL 09/2

The processor for Distributed Processor/Memory (DP/M) System was emulated using the Intel 3000 Microprocessor Chip Set. The DP/M processor is a 16-bit, two's complement, fixed point, eight register file architecture. The processor was constructed utilizing the series 3000 computing elements consisting of an array of eight Central Processing Elements (CPE) chips, one Microprogram Control Unit (MCU), one carry look ahead generator chip, and 12 control memory chips. The array of the CPE chips realized the arithmetic, logical functions and registers of the 16-bit processor. The combination of the MCU and the control memory realized the control portion of the processor. GRA

N77-25815# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
ASYNCHRONOUS ITERATIVE METHODS FOR MULTIPROCESSORS Interim Report
Gerard M. Baudet Nov. 1976 34 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-222-55)
(AD-A035932) Avail: NTIS HC A03/MF A01 CSCL 09/2

A class of asynchronous iterative methods is presented for solving a system of equations. Existing iterative methods are identified in terms of asynchronous iterations, and new schemes are introduced corresponding to a parallel implementation on a multiprocessor system with no synchronization between cooperating processes. A sufficient condition is given to guarantee the convergence of any asynchronous iterations, and results are extended to include iterative methods with memory. Asynchronous iterative methods are then evaluated from a computational point of view, and bounds are derived for the efficiency. The bounds are compared with actual measurements obtained by running various asynchronous iterations on a multiprocessor, and the experimental results show clearly the advantage of purely asynchronous iterative methods. Author (GRA)

N77-25816# Canadian Commercial Corp., Ottawa (Ontario).
A MODEL OF A PROTECTED DATA MANAGEMENT SYSTEM
Michael J. Grohn Jun. 1976 122 p refs
(Contract F19628-76-C-0025)
(AD-A035256; ESD-TR-76-289) Avail: NTIS HC A06/MF A01 CSCL 09/2

A mathematical model of a data management system embodying a military security policy is presented. Its basis in the Bell-La Padula model and the extensions required are narratively described. General notions of protection and the relational approach to data management are considered. A full, formal description of the model is included. Author (GRA)

N77-25817# Auerbach Associates, Inc., Philadelphia, Pa.
THE ANALYSIS OF CREDIBILITY AND CONSISTENCY IN INTELLIGENCE DATA Final Technical Report, Jun. 1975 - Sep. 1976
Jerome Sable and Robert Dickson Griffiss AFB, N. Y. RADC Dec. 1976 215 p ref
(Contract F30602-75-C-0330)
(AD-A036069; AAI-2329-TR-1; RADC-TR-76-392) Avail: NTIS HC A10/MF A01 CSCL 09/2

This report describes methods for the analysis, quantification and calculation of intelligence data credibility, methods for analyzing the consistency of facts stored in a scientific intelligence data base, and modifications to the Univac 1110 LISP programming language required for implementation of a scientific intelligence information system. Author (GRA)

N77-25818# System Development Corp., Santa Monica, Calif.
SOFTWARE DATA COLLECTION STUDY. VOLUME 5: SURVEY OF PROJECT MANAGERS Final Technical Report, Jun. 1975 - Jun. 1976
N. E. Willmorth Griffiss AFB, N. Y. RADC Dec. 1976 41 p
(Contract F30602-75-C-0248)
(AD-A036066; SDC-TM-5542/005/01-Vol-5;
RADC-TR-76-329-Vol-5) Avail: NTIS HC A03/MF A01 CSCL 09/2

Due to the paucity of data in the technical literature dealing with the problems, procedures and data requirements for the management and scientific investigation of software development, a survey was conducted sampling SDC project managers and military program offices. The survey asked questions concerning the willingness to supply data, sources of unreliability, the classes of data supplied and needed, and current data collection practices. Responses were received from all three services as well as SDC managers (about two-thirds of the military responses were from Air Force Agencies). Project managers were relatively willing to release all classes of data except direct dollar costs, although feelings varied widely. All projects had an organized method of planning and producing software, but few thought actual planning was adequate. (In general, projects felt that they were rushed into code production without adequate designs). Automation, standardization, systemization with full understanding of needs and provisions, and independent verification through audit checks were seen as the most promising solutions to data collection problems. GRA

N77-25819# System Development Corp., Santa Monica, Calif.
SOFTWARE DATA COLLECTION STUDY. VOLUME 3: DATA REQUIREMENTS FOR PRODUCTIVITY AND RELIABILITY STUDIES Final Technical Report, Jun. 1975 - Jun. 1976
M. C. Finfer Griffiss AFB, N. Y. RADC Dec. 1976 137 p refs
(Contract F30602-75-C-0248)
(AD-A036064; SDC-TM-5542/003/01-Vol-3;
RADC-TR-76-329-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 09/2

Ever increasing costs of software development without a parallel increase in software quality has generated much attention on software reliability, project productivity and the overall problems inherent in the software development process. One of the

objectives of the Data Collection Study is to recommend a set of parameters to be collected for the RADC Software Data Repository that will form an historical data base to support research and analyses requirements within RADC. Using past and present data collection systems and the results of a survey of the literature as guides, data parameters from contract award to software system installation are discussed. A classification of data parameters results from the examination of significant software development factors. The first class consists of project environment factors including contract and customer relations data, organizational and personnel characteristics, hardware and support facilities parameters, and overall attributes of the software product itself, such as size, complexity, etc. The second class of data is project performance information reflecting the amount and quality of work performed for the duration of the project period. Class three data consists of automatically generated product measurements, which demonstrate the structure and behavior of the product through the application of analysis tools and testing procedures. Author (GRA)

N77-25820# System Development Corp., Santa Monica, Calif.
SOFTWARE DATA COLLECTION STUDY. VOLUME 4: DATA MANAGEMENT SYSTEM INTERFACE Final Technical Report, Jun. 1975 - Jun. 1976
M. P. Templeton Griffiss AFB, N. Y. RADC Dec. 1976 79 p refs
(Contract F30602-75-C-0248)
(AD-A036065; SDC-TM-5542/004/01-Vol-4; RADC-TR-76-329-Vol-4) Avail: NTIS HC A05/MF A01 CSCL 09/2

Data collected by the RADC Data Collection and Repository System may be stored as documents and/or entered into a data base. This document explores alternate data structures, data management systems, data storage devices, and data entry devices that may be used for the data base. General recommendations are made based on the need for flexibility, security, growth potential, and ease of implementation and use. The basic recommendations are: Data should be entered via intelligent terminals at the source. The data base should be close to the point of use which means some decentralization. Data should be stored in serial records and accessed via indexes. Data access should be through a data management system which separates the logical view of the data from the physical structure and protects the data from unauthorized access or change.
Author (GRA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-25821# Florence Univ. (Italy). Istituto di Elettronica.
RPM/8. EXPERIMENTAL STUDY FOR A PROGRAMMING LANGUAGE [RPN/8. UNO STUDIO SPERIMENTALE PER UN LINGUAGGIO DI PROGRAMMAZIONE]
G. Becattini (MICROPI), S. Giusti, and F. Pirri 1976 33 p refs Partly in ITALIAN and ENGLISH
(R-6-76) Avail: NTIS HC A03/MF A01

The objectives of an interpretative language called RPN/8, for use with microcomputers of the 8-bit Child series are explained. The general working principles are outlined, and an operation description of the RPN/8 commands and operations is given. The Lukasiewicz notation is dealt with, and the object list of the RPN/8 program is presented. A survey is given of a theoretical study concerning the grammar of the language. ESA

N77-25822# TRW Systems Group, Redondo Beach, Calif. Nuclear Survivability Dept.
NONELECTRICAL LANGUAGES SIMULATION MODULE (NELSIM), VOLUME 1 Final Report
M. Epstein and J. R. Pistacchi Sep. 1976 70 p
(Contract F29601-73-C-0024)
(AD-A033592; AFWL-TR-73-256-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

NELSIM is a FORTRAN IV computer program written for the CDC 6000 series computers. NELSIM generates electric analogs from mechanical, thermal, electro mechanical, and electro optical system input descriptions. The electrical analogs generated are in a format acceptable to the SCEPTRE (System for Circuit Evaluation and Prediction of Transient Radiation Effects) program. The NELSIM output can then be executed on the SCEPTRE program to determine the system transient response. This report documents the theory and formulation utilized in the generation of NELSIM. The structure of the program and its subroutines are discussed. Also included is a sample problem section illustrating the input and output of the program and subsequent transient response obtained. Author (GRA)

N77-25823# TRW Systems Group, Redondo Beach, Calif. Nuclear Survivability Dept.
NONELECTRICAL LANGUAGES SIMULATION MODULE (NELSIM), VOLUME 2 Final Report
M. Epstein and J. R. Pistacchi Sep. 1976 106 p
(Contract F29601-73-C-0024)
(AD-A033606; AFWL-TR-73-256-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 09/2

NELSIM is a computer program developed to convert non-electrical system descriptions into electrical analogs or differential equations consistent with existing circuit analysis programs. The program provides an interface between system level problems and electrical simulation programs. The module permits engineers not familiar with disciplines generally associated with circuit simulation programs to solve system problems without manually deriving the electrical analogs and differential equations necessary to utilize such programs. Author (GRA)

N77-25824# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Electrical Engineering and Electrophysics.
EFFECT OF MANPOWER DEPLOYMENT AND BUG GENERATION ON SOFTWARE ERROR MODELS Interim Report
M. L. Shooman Griffiss AFB, N. Y. RADC Jan. 1977 85 p refs
(Contract F30602-74-C-0294)
(AD-A036106; POLY-EE/EP-76-007; RADC-TR-76-400) Avail: NTIS HC A05/MF A01 CSCL 09/2

Early software error models by Shooman and Jelinski-Moranda related the number of errors in a large software systems to the rate of error removal. Expressions for the number of remaining errors as the software undergoes debugging were formulated and additional assumptions were made to relate the number of residual errors to the operational system reliability. One of the key assumptions of the above models was that the sum of the errors removed and those remaining in the program is constant. This report adds a major refinement to the above models by introducing the possibility of error generation during debugging. In this refinement the error generation terms are modeled in several different ways 'proportional to the number of detected errors, corrected errors, the number of remaining errors, or some function of these effects. The correction rate is assumed to be a function of the manpower deployed on the project, thus permitting the use of the model to investigate optimum manpower deployment strategies. The effects on the economics of debugging due to error growth have also been analyzed. Author (GRA)

N77-25825# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
THE NOPAL LANGUAGE SPECIFICATION AND USER MANUAL
Her-Daw Che and Yung Chang Aug. 1976 133 p
(Contract DAAA25-75-C-0650)
(AD-A035610; Rept-76-04) Avail: NTIS HC A07/MF A01 CSCL 09/2

As the maintenance cost continues to soar, the application of computer program for testing components becomes necessary. This report describes the specification and usage of automatic computer program generation for Automatic Test Equipment (ATE). The function of the automatic generated program is to validate UUT (Unit Under Test) design test point availability, and packaging. The system is referred to as NOPAL, an acronym for Non-procedural Operational Performance Analysis Language. Non-proceduralness is the essential feature of the NOPAL language

in that test modules are specified modularly, and independently, one upon another. Therefore, the additions and/or modifications of tests can be incorporated easily and they are automatically attached in the proper places in the program. The report consists of five sections. Introduction, EBNF Specification, Test Module Specification, UUT Specification, and ATE Specification. For each NOPAL statement, its EBNF definition, syntax diagram and examples are provided. Author (GRA)

N77-25826# Harry Diamond Labs., Adelphi, Md.
USERS MANUAL FOR THE MODULAR ANALYSIS-PACKAGE LIBRARIES ANAPAC AND TRANL
Thomas V. Noon Nov. 1976 48 p refs
(DA Proj. 1W1-62118-AH-75)
(AD-A035209; HDL-TR-1782) Avail: NTIS HC A03/MF A01 CSCL 09/2

A user's manual for two computer software libraries is presented. The computer libraries, ANAPAC and TRANL, are a collection of modular computer programs and subroutines. The libraries contain computer routines for plotting, for interpolation, for calculating Fourier transforms, for processing digitized data, and for structuring data files. The purpose and implementation of the programs and subroutines are presented. In addition, the application of these modular programs to the Generic Assessment Methods for a Priori Hardening Systems (GAMPHS) is explained. The GAMPHS approach provides proven analytical computer programs to commodity commands to project managers for emp assessments of army systems. Author (GRA)

N77-25827# Ballistic Research Labs., Aberdeen Proving Ground, Md.
GEOMETRY PROGRAMS TO AID IN PRODUCING COMBINATORIAL GEOMETRY TARGET DESCRIPTIONS Final Report
Keith Applin and Gary Kuehl Dec. 1976 105 p
(DA Proj. 1L6-62618-AH-80)
(AD-A035060; BRL-MR-2712) Avail: NTIS HC A06/MF A01 CSCL 09/2

These programs were written for the WANG 2200 minicomputer system to increase the accuracy and reduce the time needed to develop COM-GEOM target descriptions. These programs were written for cases where quick turn-around time is imperative. This report contains a discussion, sample runs and a listing (BASIC language) for each program. Author (GRA)

N77-25828# Naval Ship Research and Development Center, Bethesda, Md.
NASTRAN ON THE TEXAS INSTRUMENTS ADVANCED SCIENTIFIC COMPUTER: FEASIBILITY STUDY AND EXPERIMENTATION Final Report
Michael E. Golden and Myles M. Hurwitz Nov. 1976 26 p ref
(XF2141028)
(AD-A035097; DTNSRDC-76-0092) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Texas Instruments Advanced Scientific Computer is a very powerful, very fast, large central memory computer for scientific applications programs. Large programs such as NASTRAN, which perform extensive numerical processing of large matrices, should require significantly less central processor time when run on such a computer. A feasibility study was carried out which addressed the possibility of running NASTRAN in a split mode on the Texas Instruments Advanced Scientific Computer at the Naval Research Laboratory and on the CDC 6000 at DTNSRDC, and included experiments on the TIASC computer. The major problem area found by the feasibility study involves transfer of data between the two computers, since the availability of a reliable, cheap, and fast means of transfer of very large amounts of data is not a certainty. If this problem can be overcome, the advantages of such a split mode operation, with respect to cost and resources, could be significant. GRA

N77-25829# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
ABSTRACTION AND VERIFICATION IN ALPHARD: DESIGN AND VERIFICATION OF A TREE HANDLER Interim Report
Mary Shaw Jun. 1976 25 p refs
(Contract F44620-73-C-0074; Grant NSF DCR-74-04187)
(AD-A035562; AFOSR-77-0053TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

The design of the Alphard programming language has been strongly influenced by ideas from the areas of programming methodology and formal program verification. The interaction of these ideas and their influence on Alphard are described by developing a nontrivial example, a program for manipulating the parse tree of an arithmetic expression. GRA

N77-25830# Federal COBOL Compiler Testing Service, Washington, D. C.
COBOL COMPILER VALIDATION SUMMARY REPORT
25 Jan. 1977 44 p
(AD-A035518; CCVS68-VSR170) Avail: NTIS HC A03/MF A01 CSCL 09/2

This Validation Summary Report VSR for the Burroughs Corporation 6700/7700 COBOL Compiler Version 2.9 MCP Version 2.8 'provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1968 COBOL Standard X3.23-1968/FIPS PUB 21'. The Compiler was validated at the High Level of FIPS PUB 21. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1968 a section relating the categories of discrepancies to each of the Federal levels of the language and a detailed listing of discrepancies together with the tests which were failed. GRA

N77-25831# Computer Sciences Corp., Huntsville, Ala.
LANGUAGE CONTROL FACILITY (LCF). VOLUME 7: COMPONENT REQUIREMENTS FOR THE LCF Final Technical Report, 1 Oct. 1975 - 1 Jul. 1976
William Anderson, Terry L. Dunbar, Peter L. Belford, and Richard Gilinski Griffiss AFB, N. Y. RADC Dec. 1976 183 p refs 2 Vol.
(Contract F30602-76-C-0024)
(AD-A035811; CSC-4549-110-Vol-1; RADC-TR-76-386-Vol-1)
Avail: NTIS HC A09/MF A01 CSCL 09/2

This effort was undertaken to identify the necessary facilities, operating procedures, personnel, and software tools to effectively control the proliferation of Higher Order Languages for computer programming. This control would allow the Air Force (and all of DOD) to standardize on the use of a few well controlled programming languages. This in turn would promote the use of Higher Order Langages over Machine Oriented Languages with the added advantage of smaller development and maintenance costs for software, reduced training costs for programmers, and increased transferability of both software and programmers.
Author (GRA)

N77-25832# Computer Sciences Corp., Huntsville, Ala.
LANGUAGE CONTROL FACILITY (LCF) STUDY. EVALUATION OF THE SOFTWARE TOOLS FOR THE LCF Final Report, 1 Oct. 1975 - 1 Jul. 1976
William Anderson, Terry L. Dunbar, Peter L. Belford, and Richard Gilinski Griffiss AFB, N. Y. RADC Dec. 1976 182 p refs 2 Vol.
(Contract F30602-76-C-0024; AF Proj. 5550)
(AD-A035915; CSC-4549-110-Vol-6; RADC-TR-76-386-Vol-2)
Avail: NTIS HC A09/MF A01 CSCL 09/2
For abstract, see N77-25831.

N77-25833# PRC Data Services, Inc., McLean, Va.
A REVIEW OF DATA COMPRESSION ALGORITHMS
C. Holborow, J. McNemar, and P. Stoneburner 1 May 1976 154 p refs
(Contract DCA100-73-C-0015)
(AD-A035786; CCTC-TM-122-76) Avail: NTIS HC A08/MF A01 CSCL 09/2

This memorandum describes various methods for compressing digital computer data files. The objective of the methods described is to reduce the physical space required to store data while maintaining a complete representation of the information. There are several potential benefits associated with compression. It provides more efficient use of storage devices, it improves data transfer rates, through shorter message packets, and it permits faster data base access, through greater data density per IO

storage BLOCK. The document first discusses logical compression techniques and identifies some data base methods which minimize storage. Next, the document describes methods which achieve compression through various encoding schemes. The concepts for the development and operation of these methods are discussed, and guidance is provided for their appropriate application. Performance characteristics are delineated when operational statistics are known. Author (GRA)

N77-25834# TRW Systems Group, Redondo Beach, Calif.
FORTRAN CODE AUDITOR. VOLUME 1: USER'S MANUAL Final Technical Report, May 1975 - Jan. 1976
Paul Smith Dec. 1976 54 p
(Contract F30602-76-C-0187; AF Proj. 5581)
(AD-A035778; RADC-TR-76-395-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

The FORTRAN Code Auditor, an automated test tool, is used for the cost effective enforcement of FORTRAN programming standards and conventions appropriate to the Air Force software environment. It does not modify code. Using predefined coding standards and conventions, it simply advises the user where these standards and conventions have not been adhered to. The major advantage of favoring an automated auditor over manual methods, besides cost effectiveness, is complete objectivity and unambiguity. The standards can be viewed as being coding enforcements in four areas: documentation standards - standards defining quantity and placement of commentary thus enhancing program readability and comprehensive format standards - standards identifying physical placement and grouping of code elements on the source code listing design standards - standards limiting module size and placing restrictions on the use of certain instructions with the end result of providing an optimization of code relative to execution time and structural standards - standards requiring the use of strict rules for the top-down design and implementation of a system of programs and the requirement that the components adhere to a hierarchical form as much as possible. Author (GRA)

N77-25835# Yale Univ., New Haven, Conn. Dept. of Computer Science.
RESEARCH AT YALE IN NATURAL LANGUAGE PROCESSING
Roger C. Schank 1976 35 p refs
(Contract N00014-75-C-1111)
(AD-A035874; RR-84) Avail: NTIS HC A03/MF A01 CSCL 05/7

This report describes the state of the computer programs at Yale that do automatic natural language processing as of the end of 1976. The theory behind the programs shown here as well as descriptions of how those programs function, has been described elsewhere. This report summarizes the capabilities of 5 computer programs at the present time. GRA

N77-25836# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
THE REFORMULATION MODEL OF EXPERTISE Ph.D. Thesis
William Scott Mark Dec. 1976 254 p refs
(AD-A035397; MIT/LCS/TR-172) Avail: NTIS HC A12/MF A01 CSCL 09/2

This research develops a methodology for implementing a class of expert problem-solving programs which must create models of the problems they are given before they can apply their expert knowledge to those problems -- i.e., given a problem in their domain of expertise, these programs 'reformulate' the problem description in terms of their built-in abstract models of the domain. The implementation methodology provides the following capabilities: (1) pieces of expert knowledge can be added to the program in a fairly independent manner without regard to their control structure implications; (2) programs can delve through irrelevant information in the problem description to pick out only the facts needed for problem-solving; (3) programs can model the input problem at various levels of detail, as required by the problem-solving task; and (4) programs can tailor their expert models to the problem at hand. This is accomplished by controlling the general procedure which maps pieces of the expert model into pieces of the input with feedback information taken from the model of the input so far. GRA

N77-25837# University of Southern Calif., Marina del Rey. Information Sciences Inst.
ABSTRACTION AND VERIFICATION IN ALPHARD: A SYMBOL TABLE EXAMPLE
Ralph L. London, Mary Shaw (Carnegie-Mellon Univ., Pittsburgh), and William A. Wulf (Carnegie-Mellon Univ., Pittsburgh) 29 Dec. 1976 33 p refs
(Contract DAHC15-72-C-0308; Grant NSF DCR-74-04187)
(AD-A035461; ISI/RR-76-51) Avail: NTIS HC A03/MF A01 CSCL 09/2

The design of the Alphard programming language has been strongly influenced by ideas from the areas of programming methodology and formal program verification. This paper designs, implements, and verifies a general symbol table mechanism. This example is rich enough to allow an illustration of the use as well as the definition of programmer-defined abstractions. The verification illustrates the power of the form to simplify proofs by providing strong specifications of such abstractions. GRA

N77-25838# Naval Postgraduate School, Monterey, Calif.
APL HISTOGRAM, DENSITY ESTIMATION AND PROBABILITY PLOTTING ROUTINES M.S. Thesis
Dennis Roy Hutchinson Dec. 1976 98 p refs
(AD-A035883) Avail: NTIS HC A05/MF A01 CSCL 09/2

This paper introduces several data analysis routines that were designed for interactive use with APL (A Programming Language) and placed in the APL user library at the Naval Postgraduate School. Specifically, histograms, density estimation and probability plotting routines are both explained in detail and demonstrated with actual data. In addition, applications and limitations on each of the routines are explored. And, the combined routines give the general user an extensive tool to analyze either discrete or continuous data. Author (GRA)

N77-25839# Naval Postgraduate School, Monterey, Calif.
DESIGN AND IMPLEMENTATION OF LARGE SCALE PRIMAL TRANSSHIPMENT ALGORITHMS
Gordon H. Bradley, Gerald G. Brown, and Glenn W. Graves Sep. 1976 64 p refs
(AD-A035320; NPS-55BZBW76091) Avail: NTIS HC A04/MF A01 CSCL 12/2

A complete description is given of the design, implementation and use of a family of very fast and efficient large scale minimum cost primal network programs. Choice of data structures and computational testing of the network system Gnet are discussed. Important extensions are explained such as exploitation of special problem structure, element generation techniques, post optimality analysis, operation with problem generators and external problem files, and generalization beyond pure network models. GRA

N77-25840# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
MSG: THE INTERPROCESS COMMUNICATION FACILITY FOR THE NATIONAL SOFTWARE WORKS, REVISION 1
Robert H. Thomas and Stuart C. Schaffner 23 Dec. 1976 99 p refs Revised
(Contract N00014-75-C-0773)
(AD-A035087; BBN-3483-Rev-1; CAAD-7612-2411) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes the communication facility, named MSG, which was developed to support interprocess communication for the implementation of the National Software Works (NSW). The more important of the processes which comprise NSW and the pattern of communication which those processes require are described. Next from those patterns a model of interprocess communication which is sufficient for NSW is abstracted. Finally, the details of the MSG facility itself are developed. Author (GRA)

N77-25841# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ALGORITHM FOR RECOGNITION OF RUSSIAN CHARACTERS USING CORRELATION M.S. Thesis
William Ray McHargue Dec. 1976 96 p refs
(AD-A035287; GE/EE-76-35) Avail: NTIS HC A05/MF A01 CSCL 06/4

An algorithm for an optical character recognition system

that reads Russian letters was designed with spatial Fourier transform components as feature indicators. The algorithm employs crosscorrelation of isolated prototype letters with data letters as the recognition scheme. A flying spot scanner and a PDP-12 were used to transform the letters and make correlation calculations. Only partial testing has been made on the system as it requires 25 minutes for each identification in its present form. These partial results are encouraging and testing should continue. GRA

N77-25842# Naval Ship Research and Development Center, Bethesda, Md.

COMRADE EXECUTIVE SYSTEM USERS MANUAL

Robert W. Tinker and Ira L. Avrunin Jan. 1976 90 p refs
(AD-A035282; DTNSRDC-76-0002) Avail: NTIS HC A05/MF A01 CSCL 09/2

The COMRADE Executive System is a set of general purpose interactive supervisory software, currently operational on the DTNSRDC CDC-6700 SCOPE 3.4 computer system, which facilitates the definition, construction, and execution of sequences of computer activities called command procedures. Such activities include issuing tutorials, accepting user input, attaching files, and executing application programs. This report describes the use of the Executive System for constructing integrated systems of application programs and user-oriented system interfaces, and discusses the Executive's administrative and interpretive functions, the communications involved and various internal utility routines called upon. Particular emphasis is placed on the interpretive functions and the primitive operations which are performed in response to user requests. The use of the Procedure Definition Language to define the activity sequence of a command procedure is also described. Author (GRA)

N77-25843# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.

ON A COMPUTER SYSTEM FOR PLANNING AND EXECUTION IN INCOMPLETELY SPECIFIED ENVIRONMENTS

Steven Jay Weissman Aug. 1976 143 p refs
(Contracts DAAB07-72-C-0259; F33615-73-C-1238)
(AD-A034991; R-741; UILU-ENG-76-2229) Avail: NTIS HC A07/MF A01 CSCL 09/2

In order to construct computer planning systems which can solve more complex and realistic tasks, one must consider the problems involved with planning and execution in broader domains. Problems associated with operating in domains which are not completely specified at the time of initial planning are considered. A major problem is how to satisfy goals when some possibly relevant information is unknown. A method for deferring detailed planning to satisfy goals until a time when new information becomes available is discussed. The plans produced take the form of outlines which specify the major actions which have to be executed. As new information is obtained, additional operations are added to the plan, filling in details of the outline. Problems involved with how to determine whether information is missing as well as how to obtain the information are discussed. In this system an attempt is made to relax the distinction between planning and execution phases. Execution of actions must be able to be initiated before a completely detailed plan has been constructed. While executing a portion of a plan, observations or other sensory inputs could be made in order to obtain new information. GRA

N77-25844# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.

PROFGEN: A COMPUTER PROGRAM FOR GENERATING FLIGHT PROFILES Final Report, Jun. 1975 - Feb. 1976

Stanton H. Musick Nov. 1976 199 p refs
(AD-A034993; AFAL-TR-76-247) Avail: NTIS HC A09/MF A01 CSCL 01/2

The PROFGEN computer program calculates flight path data for an aircraft moving over the earth. Written in FORTRAN, the program is intended to support simulations that require a six degree-of-freedom trajectory driver. PROFGEN computes the position, velocity, acceleration, attitude and attitude rate of an aircraft flying over an ellipsoidal earth and responding to maneuver commands specified by the program user. Four types of maneuver commands are available: vertical turn, horizontal turn, sinusoidal heading change and straight flight. In addition, a speed change may be superimposed on any maneuver. Extended flight speed change may be superimposed on any maneuver. Extended flight paths are created by stringing together a sequence of maneuvers. PROFGEN uses a fifth-order numerical integrator to solve the kinematic equations of motion. PROFGEN was developed on a CDC CYBER-74 computer where it compiles in about six seconds and uses less than 60,000 words of memory. The program includes a plotting capability that increases the memory requirement to 137,000 when installed. GRA

N77-25845# TRW, Inc., Redondo Beach, Calif.

FORTRAN CODE AUDITOR: PROGRAM MAINTENANCE MANUAL Final Report, May 1975 - Jan. 1976

Paul Smith Dec. 1976 82 p
(Contract F30602-76-C-0187; AF Proj. 5581)
(AD-A035914; RADC-TR-76-395-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 09/2

The FORTRAN code auditor, an automated test tool, is used for cost effective enforcement of FORTRAN programming standards and conventions appropriate to the Air Force software environment. It does not modify code. Using predefined coding standards and conventions, it simply advises the user where these standards and conventions have not been adhered to. The major advantage of favoring an automated auditor over manual methods, besides cost effectiveness, is complete objectivity and umbiguity. The standards can be viewed as being coding enforcements in four areas: (1) Documentation Standards - Standards defining quantity and placement of commentary thus enhancing program readability and comprehensiveness (2) Format Standards - Standards identifying physical placement and grouping of code elements on the source code listing (3) Design Standards - Standards limiting module size and placing restrictions on the use of certain instructions with the end result of providing an optimization of code relative to execution time (4) Structural Standards - Standards requiring the use of strict rules for the top-down design and implementation of a system of programs and the requirement that the components adhere to a hierarchical form as much as possible. GRA

N77-25846# Texas Univ., Austin. Center for Cybernetic Studies.

THE ALTERNATING BASIS ALGORITHM FOR ASSIGNMENT PROBLEMS

Richard S. Barr (Southern Methodist Univ.), Fred Glover (Colorado Univ., Boulder), and Darwin Klingman Jan. 1977 31 p refs
(Contracts N00014-76-C-0616; N00014-75-C-0569; N00014-76-C-0383; NR Proj. 047-021)
(AD-A035919; CCS-263) Avail: NTIS HC A03/MF A01 CSCL 12/2

The purpose of this paper is to present a new primal extreme point algorithm for solving assignment problems. The new algorithm both circumvents and exploits degeneracy. Degeneracy difficulties of the standard primal simplex methods result from the unnecessary inspection of alternative basis representations of the extreme points. This paper characterizes a subset Q of all bases that are capable of leading to an optimal solution to the problem if one exists. The new algorithm is based on a special set of transition rules that make it possible to examine only bases in Q. The graph structure of Q imparts a number of computational advantages to the algorithm. A preliminary computer implementation, without refinement or investigation of alternative choice rules, is more efficient and uses less computer memory than the currently best implementations of out-of-kilter, primal-dual, and primal extreme point methods for assignment problems. GRA

N77-25847# Texas Univ., Austin. Center for Cybernetic Studies.

A NEW ALTERNATING BASIS ALGORITHM FOR SEMI-ASSIGNMENT NETWORKS

Richard S. Barr (Southern Methodist Univ.), Fred Glover (Colorado Univ., Boulder), and Darwin Klingman Jan. 1977 33 p refs Presented at Bicentennial Conf. on Math. Programming, Gaithersburg, Md., 30 Nov. - 1 Dec. 1976
(Contracts N00014-75-C-0616; N00014-75-C-0569; N00014-76-C-0383; NR Proj. 047-021)
(AD-A035920; CCS-264) Avail: NTIS HC A03/MF A01 CSCL 12/2

During the early 1970's, highly efficient special purpose computer codes were developed for solving capacitated transshipment problems based on primal extreme point algorithms. Computational comparisons disclosed that these codes were substantially superior to the best non-extreme point codes both in terms of computer time and memory requirements on all types of network problems. More recently, non-extreme point codes have been developed that are highly specialized for specific types of uncapacitated bipartite problems--notably assignment and semi-assignment problems. Comparisons of these problem specific codes with the earlier general purpose codes have raised the question of whether non-extreme point methods may not be superior to primal extreme point methods in application to these special network problem types. Consequently, the purpose of this paper is twofold: (1) to develop a new primal extreme point algorithm which is specifically designed to take advantage of the bipartite and Boolean flow structures of assignment and semi-assignment problems, and (2) to conduct an unbiased comparison of the alternative algorithmic approaches for solving assignment and semi-assignment problems. GRA

N77-25848# Texas Univ., Austin. Center for Cybernetic Studies.
SOME RECENT PRACTICAL MISCONCEPTIONS ABOUT THE STATE OF THE ART OF NETWORK ALGORITHMS
Fred Glover and Darwin Klingman Aug. 1976 11 p refs
(Contracts N00014-75-C-0616; N00014-75-C-0569; N00014-76-C-0383; NR Proj. 047-021)
(AD-A035921; CCS-270) Avail: NTIS HC A02/MF A01 CSCL 12/2

The purpose of this technical note is to correct several errors and misconceptions in a recent article appearing in Operations Research concerning the state of the art in network solution methods and their computer implementations. GRA

N77-25849# Ballistic Research Labs., Aberdeen Proving Ground, Md.
NEWT: A COMPUTER CODE FOR CALCULATING THE KINEMATIC VARIABLES OF A PROJECTILE SUBJECT TO A SECOND ORDER DRAG LAW THAT IS PENETRATING AN ELASTIC-PLASTIC MEDIUM Final Report
William B. Beverly Dec. 1976 33 p refs
(DA Proj. 1W6-62618-AH-80)
(AD-A034998; BRL-MR-2711) Avail: NTIS HC A03/MF A01 CSCL 19/4

The motion of a projectile in an elastic-plastic medium can often be adequately described by a second order drag law. The differential equations describing this motion have been solved for a projectile of impacting velocity V sub 0 and frontal area pi R squared and a computer program NEWT has been written in the BASIC language to calculate the penetration, velocity, and energy deposition of the projectile at subsequent times. The code was written to describe projectiles in tissue simulant but it can be used to predict any motion described by a second-order drag law. The differential equations and their solutions are discussed in detail. A flow chart and code listing are given. A description of the user-supplied input is given. Representative test problems are solved and their solutions are discussed.
Author (GRA)

N77-25850# System Development Corp., Santa Monica, Calif.
SOFTWARE DATA COLLECTION STUDY. VOLUME 1: SUMMARY AND CONCLUSIONS Final Technical Report, Jun. 1975 - Jun. 1976
N. E. Willmorth, M. C. Finfer, and M. P. Templeton Griffiss AFB, N. Y. RADC Dec. 1976 123 p
(Contract F30602-75-C-0248)
(AD-A036115; DSC-TM-5542/001/01-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

The burgeoning costs of software development have centered research interest in software methodology, project productivity and program reliability. However, such research is hindered by the lack of standard, reliable data for an adequate sample of software projects upon which to base conclusions. RADC proposes to establish a repository in which software development data may be accumulated; this study was conducted to generate recommendations concerning a data collection systems for that repository. The objective of the study was to investigate: Data collection problems; Data requirements for productivity, software reliability and cost studies; Data entry/data management interface; Specifications for a software data collection and reporting system. GRA

N77-25851# System Development Corp., Santa Monica, Calif.
SOFTWARE DATA COLLECTION STUDY. VOLUME 2: AN ANALYSIS OF SOFTWARE DATA COLLECTION PROBLEMS AND CURRENT CAPABILITIES Final Technical Report, Jun. 1975 - Jun. 1976
N. E. Willmorth, M. C. Finfer, and M. P. Templeton Griffiss AFB, N. Y. RADC Dec. 1976 127 p refs
(Contract F30602-75-C-0248)
(AD-A036116; SDC-TM-5542/002/01-Vol-2; RADC-TR-76-329-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 09/2

The current state of software data collection leaves much to be desired. There is no comprehensive base of software development information, and the data that are gathered lack reliability, accuracy and validity. Data gathered from diverse sources and projects are not comparable due to a lack of standardization in meaning, measuring techniques and collection procedures. One of the chief obstacles to gathering more reliable data are project resistance to managerial control and reluctance to release data that might reflect on project efficiency or reveal proprietary technology. This report reviews the literature dealing with software data collection problems, evaluates current military data collection practices, and surveys briefly some project monitor systems that could aid in the collection of more valid and reliable data. The alternatives available in managing a software data collection operation facility are also examined. Actions leading to objective, reliable and standard measures and for removing some of the subjectivity of measures are considered. No easy or fine solutions are seen, but improvements are attainable to technological and managerial changes and through economic inducements to provide better data. Author (GRA)

N77-25852# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
INITIAL REPORT ON A LISP PROGRAMMER'S APPRENTICE
Charles Rich and Howard E. Shrobe Dec. 1976 214 p refs Revised
(Contracts N00014-75-C-0643; N00014-75-C-0522)
(AD-A035943; MIT-AI-TR-354-Rev) Avail: NTIS HC A10/MF A01 CSCL 09/2

The conceptual basis of the system lies in three forms of program description: (1) definition of structured data objects, their parts, properties, and relations between them, (2) input-output specification of the behavior of program segments (SPECS), and (3) a hierachical representation of the internal structure of programs (plans). The major theoretical work reported here is a representation for program plans which includes data flow, control flow, and also goal-subgoal prerequisite, and other dependency relationships between the segments of the program.
Author (GRA)

N77-25853# Federal COBOL Compiler Testing Service, Washington, D. C.
COBOL COMPILER VALIDATION SUMMARY REPORT
28 Jan. 1977 42 p
(AD-A035212; CCVS68-VSR165) Avail: NTIS HC A03/MF A01 CSCL 09/2

The purpose of the Validation Summary Report (VSR) is to identify individual COBOL language elements whose usage does not conform to Federal Standard COBOL as adopted from American National Standard COBOL (X3-23-1968) by Federal Information Processing Standards Publication 21 (FIPS PUB 21). The Validation Summary Report is prepared by analyzing the results of running the COBOL Compiler Validation System (CCVS). The COBOL Compiler Validation System consists of audit routines containing features of Federal Standard COBOL, their related data, and an executive routine (VP-routine) which prepares the audit routines for compilation. Each audit routine is a COBOL program which includes tests and supporting procedures used to indicate the results of the tests. The testing of a compiler in a particular hardware/operating system

environment is accomplished by compiling and executing each audit routine. GRA

N77-25061# Ultrasystems, Inc., Irvine, Calif.
CAST: A COMPLEMENTARY ANALYTIC-SIMULATIVE TECHNIQUE FOR MODELING COMPLEX, FAULT-TOLERANT COMPUTING SYSTEMS
R. B. Conn, P. M. Merryman, and K. L. Whitelaw *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 27 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

N77-25064# IBM Watson Research Center, Yorktown Heights, N.Y.
TECHNIQUES FOR MICROPROGRAM VALIDATION
W. C. Carter, H. A. Ellozy, W. H. Joyner, Jr., and G. B. Leeman, Jr. *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 19 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

62 COMPUTER SYSTEMS

Includes computer networks.

N77-25854# University of Southern Calif., Marina del Rey. Information Sciences Inst.
AN INVESTIGATION OF THE EFFECTS OF OUTPUT VARIABILITY AND OUTPUT BANDWIDTH ON USER PERFORMANCE IN AN INTERACTIVE COMPUTER SYSTEM
Lawrence H. Miller Dec. 1976 76 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A036089; ISI/RR-76-50) Avail: NTIS HC A05/MF A01 CSCL 09/2

The performance of users in man-machine interaction (MMI) is described in terms of a number of user- and machine-oriented parameters. The effects of varying CRT display rates and output delays upon user performance and attitudes in a series of message retrieval tasks were evaluated experimentally. The results support the somewhat surprising conclusion that doubling the display rate from 1200 to 2400 baud produces no significant performance or attitude changes; increasing the variability of the output display rate produces both significantly decreased user performance and a poorer attitude towards system and interactive environment. The questionnaire, which elicited user's attitudes toward the system, correlates with performance on the interactive tasks. The importance of these results to designers of MMS is discussed. GRA

N77-25855# University of Southern Calif., Los Angeles. Image Processing Inst.
DIGITAL COLOR IMAGE RESTORATION
Clanton E. Mancill Aug. 1975 159 p refs
(Contract F08606-72-C-0008; ARPA Order 1706)
(AD-A034749; USCIPI-630) Avail: NTIS HC A08/MF A01 CSCL 14/5

The restoration of color errors in digitally recorded color images is considered in this dissertation. A vector space model of a general digital color image recording system is derived and the equations representing the model and the equations of colorimetry are expressed in matrix form. Computer algorithms are derived which correct color errors introduced by imperfections in the color recording system. The sources of color error which are considered include sensor spectral responses which depart from ideal color matching curves, crosstalk between color signal channels, and system nonlinearities. The special case of a color film-digital scanner system is examined in detail, although the methods derived apply to a wider class of color or multispectral sensing and recording systems. The success of the correction algorithms is demonstrated using a computer simulation of the film-scanner system. The algorithms for correction of spectrally imperfect sensors are also tested using a specially created six band multispectral test image. GRA

N77-25856# Defense Systems Management School, Fort Belvoir, Va.
CONFIGURATION MANAGEMENT FOR THE DEVELOPMENT OF COMPUTER SYSTEMS
Mark D. Anway Nov. 1976 41 p refs
(AD-A036782) Avail: NTIS HC A03/MF A01 CSCL 05/1

This study examines configuration management as defined in Department of Defense publications for major defense systems and applies configuration management to the development of computer systems. DOD Directives, DOD Instructions, Military Standards, and Air Force publications provide the primary source of configuration management principles and functions. Configuration management has had limited application to embedded computer systems and even less to general purpose computer systems. The study discusses configuration management principles in the computer system environment and concludes that these principles can be and should be applied to the development of computer systems. To demonstrate that conclusion, the principles are applied to a specific Air Force program, the Base Level Data Automation Program (Phase 4). Author (GRA)

N77-25072*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGHLY RELIABLE MULTIPROCESSORS
Nicholas D. Murray, Albert L. Hopkins (Charles Stark Draper Lab., Inc.), and John H. Wensley (Stanford Res. Inst., Menlo Park, Calif.) *In* AGARD Integrity in Electron. Flight Control Systems Apr. 1977 17 p refs (For primary document see N77-25055 16-01)
Avail: NTIS HC A16/MF A01

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N77-25857 British Library Lending Div., Boston Spa (England).
USE OF HIDDEN EFFECTS IN AUTOMATIC CONTROL SYSTEMS
V. A. Danielyan, V. P. Avdeev, Yu A. Sarapulov, I. P. Strokov, and V. A. Stolyar [1977] 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. (USSR) v. 12, 1975 p 147-150
(BLL-M-25371-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The general concept of the purposefulness of formulated hidden effects in man machine control systems is examined. The approved method of utilizing corresponding signals is considered on the basis of examples from blast furnace production. Author

N77-25858# Pattern Analysis and Recognition Corp., Rome, N. Y.
MULTICS OLPARS OPERATING SYSTEM, VOLUME 1 Final Technical Report, Jun. 1973 - Jun. 1976
David B. Connell, Kermit N. Klingbail, and Richard A. Jackson Sep. 1976 226 p refs
(Contracts F30602-75-C-0226)
(AD-A034393; PAR-74-25-A-Vol-1; RADC-TR-76-271-Vol-1)
Avail: NTIS HC A11/MF A01 CSCL 09/2

The development of interactive graphics computer systems for use in detection, identification, and transformation of patterns contained in high-dimensional data has been a continuing program at the Rome Air Development Center since 1968. This long standing effort has resulted in the implementation of OLPARS (the On-Line Pattern Analysis and Recognition System), IFES (the Image Feature Extraction System), and WPS (the Waveform Processing System). This report contains detailed design and user-oriented information related to MOOS (the MULTICS OLPARS Operating System), and advanced version of OLPARS currently resident upon the Honeywell 6180 MULTICS computer system. The currently operational system represents an implemented version of the operations described in a previous report (RADC-TR-73-241); appropriate selections of that report are retained within this document. This report contains brief

descriptions of the MOOS system and the mathematics underlying the system algorithms. A major portion of this document is reserved for a user's manual (providing detailed information relating to the operation of all system options) and for MOOS program documentation. Author (GRA)

N77-25859# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

STRUCTURAL PROPERTIES OF LINEAR DYNAMIC SYSTEMS: APPLICATION TO OPTIMAL CONTROL AND FILTERING

Omer L. Mercier Mar. 1977 26 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-403)

(ONERA-NT-1977-4; FR-ISSN-0078-3781) Avail: NTIS HC A03/MF A01

The major results concerning the modern concepts of controllability, observability, reconstructibility, stability, stabilizability, and detectability of linear dynamic systems are presented. These concepts, developed during the 1960 to 1972 period, are of prime importance for the control of dynamic systems, especially to design feedback controls and to synthesize the filters, state reconstructors, and observers usually associated with these controls. Author (ESA)

N77-25860# Pattern Analysis and Recognition Corp., Rome, N. Y.

MULTICS OLPARS OPERATING SYSTEM, VOLUME 2 Final Technical Report, Jun. 1973 - Jun. 1976

David B. Connell, Kermit N. Klingbail, and Richard A. Jackson Griffiss AFB, N. Y. RADC Sep. 1976 660 p

(Contracts F30602-75-C-0226; F30602-73-C-0352)

(AD-A033437; PAR-74-25-B-Vol-2; RADC-TR-76-271-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 09/2

The development of interactive graphics computer systems for use in the detection, identification, and transformation of patterns contained in high-dimensional data has been a continuing program at the Rome Air Development Center since 1968. This long standing effort has resulted in the implementation of OLPARS (the On-line Pattern Analysis and Recognition System), IFES (the Image Feature Extraction System), and WPS (the Waveform Processing System). This report contains detailed design and user-oriented information related to MOOS (the Multics OLPARS Operating System), an advanced version of OLPARS, currently resident upon the Honeywell 6180 MULTICS computer system. The current operational system represents an implemented version of the operations described in a previous report (RADC-TR-73-241); appropriate selections of that report are retained within this document. This report contains brief descriptions of the MOOS system and the mathematics underlying the system algorithms. A major portion of this document is reserved for a user's manual (providing detailed information relating to the operation of all system options) and for MOOS program documentation. GRA

N77-25861# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

IMAGE UNDERSTANDING AND INFORMATION EXTRACTION Interim Report, 1 Feb. - 30 Apr. 1976

Thomas S. Huang and King Sun Ku Griffiss AFB, N. Y. RADC Sep. 1976 105 p

(Contract F30602-75-C-0150; ARPA Order-2893)

(AD-A033397; RADC-TR-76-304) Avail: NTIS HC A06/MF A01 CSCL 09/2

The objective of the research is to achieve a better understanding of image structure and to use this knowledge to develop techniques for image analysis and processing tasks, especially information extraction. The emphasis is on the syntactic decomposition and recognition of imagery based on scene analysis. It is hoped that this research will form the basis for the development of technology relevant to military applications of machine extraction of information from aircraft and satellite imagery. GRA

N77-25862# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

IMAGE UNDERSTANDING AND INFORMATION EXTRACTION Interim Report, 1 Nov. 1975 - 31 Jan. 1976

Thomas S. Huang and King Sun Fu Griffiss AFB, N. Y. RADC Sep. 1976 113 p refs

(Contract F30602-75-C-0150; ARPA Order-2893)

(AD-A033398; RADC-TR-76-303) Avail: NTIS HC A06/MF A01 CSCL 09/2

The objective of this research is to achieve a better understanding of image structure and to use this knowledge to develop techniques for image analysis and processing tasks, especially information extraction. The emphasis is on the syntactic decomposition and recognition of imagery based on scene analysis. It is hoped that the results of this research will form the basis for the development of technology relevant to military applications of machine extraction of information from aircraft and satellite imagery. GRA

N77-25863# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

STRONG DEPENDENCY: A FORMALISM FOR DESCRIBING INFORMATION TRANSMISSION IN COMPUTATIONAL SYSTEMS

Ellis S. Cohen Aug. 1976 89 p refs

(Contract F44620-73-C-0074; Grant NSF MCS-75-07251-A01; ARPA Order 2446)

(AD-A035618; AFOSR-77-0054TR) Avail: NTIS HC A05/MF A01 CSCL 09/2

This paper presents an information theoretic approach to information transmission in computational systems. The effect of constraint on information paths is formalized and a number of inductive techniques are developed for proving the absence of information transmission. Finally, it is shown how ordinary inductive assertions can be used in conjunction with the theory to analyze information paths in sequential programs. GRA

N77-25864# Maryland Univ., College Park. Computer Science Center.

ALGORITHMS AND HARDWARE TECHNOLOGY FOR IMAGE RECOGNITION Semiannual Report, 1 May - 31 Oct. 1976

Azriel Rosenfeld and David Milgram 31 Oct. 1976 131 p refs

(Contract DAAG53-76-C-0138; DARPA Order 3206)

(AD-A035038) Avail: NTIS HC A07/MF A01 CSCL 17/5

Techniques for detecting tactical targets on Forward-Looking Infrared (FLIR) imagery are being investigated. The principal topics covered include target and background models, object extraction and classification, and hardware technology applicable to real-time implementation. Author (GRA)

N77-25865# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

SWITCHING SYSTEM SIMULATOR M.S. Thesis

Charles R. Williams Dec. 1976 139 p refs

(AD-A035289; GE/EE-76-45) Avail: NTIS HC A07/MF A01 CSCL 09/3

Switching System Simulator (SSS) is a CDC 6600 computer program which simulates and evaluates networks of interconnected switching elements. SSS determines all the possible ways in which a given switching system can complete a set of input/output connections. SSS is not limited to specific types of switching systems but allows the user to define the functions required. The SSS input source program is taken from a schematic diagram of the switching system to be simulated. Each input, output and interconnecting path must be labeled with a unique name. Using the SSS input language, the user prepares the source program which defines all the pertinent characteristics of the switching system as well as the required input/output connections. SSS compiled a computer model of the switching system based on the input source program and outputs a list of all the possible switching element positions which satisfy the required input/output connections. A user's manual is included as part of this thesis which describes the capabilities, features and input language conventions of SSS. Author (GRA)

N77-25866# Rensselaer Polytechnic Inst., Troy, N. Y. Computer Research Lab.

COMPUTER RECONSTRUCTION OF BODIES BOUNDED BY QUADRIC SURFACES FROM A SET OF IMPERFECT PROJECTIONS Interim Report

Ruth Shapira Sep. 1976 120 p refs
(Grants AF-AFOSR-2937-76; AF-AFOSR-2755-75)
(AD-A035563; CRL-48; AFOSR-77-0051TR) Avail: NTIS HC A06/MF A01 CSCL 09/2

This thesis describes a computer program for constructing a description of solid bodies from a set of n pictures of the bodies. The bodies are assumed to be bounded by faces which are quadric or planar, and they are restricted to have all their vertices formed by exactly three faces. The pictures are taken from different vantage points, with the restriction that a slight shift in vantage point will not alter the topology of the picture. It is assumed that the program receives outline information from a preprocessor which has extracted this information from the pictures. The outline information, set of line structures, may be imperfect in that some junctions may be erroneously reported and some lines may be missing. However, all lines due to shadows are assumed to have been eliminated by the processor. GRA

N77-25867# Illinois Univ., Urbana-Champaign.
STABILITY AND MULTI-MODELS IN MODEL REFERENCE ADAPTIVE SYSTEMS Ph.D. Thesis
Dale Keith Barbour Aug. 1976 175 p refs
(Contract DAAB07-72-C-0259; Grant AF-AFOSR-2570-73)
(AD-A034992; R-740; UILU-ENG-76-2228) Avail: NTIS HC A08/MF A01 CSCL 12/1

Several problems related to model reference adaptive systems (MRAS) are investigated. The MRAS finds application both in control system design in an uncertain environment and in parameter identification. The development here is based on a parallel MRAS structure whose adaptation design guarantees that the MRAS is hyperstable. A method is found, based on controllability conditions of a particular MRAS subsystem state representation, to produce a reduced-order reference model without losing the inherent hyperstable property of the MRAS design. For MRAS applied to parameter identification, we consider two problems. Necessary and sufficient conditions guaranteeing asymptotic stability of the parameter-error are found. For a specific discrete-time hyperstable MRAS, we consider the difficulty in realizing the hyperstable design due to the nature of the identification problem. An alternate design is proposed and a strategy for investigating its stability properties is described. For a continuous-time MRAS control system with discontinuous adaptation, variable structure system theory is used to establish its stability. GRA

N77-25868# University of Southern Calif., Marina del Rey. Information Sciences Inst.
MAN-MACHINE COMMUNICATION RESEARCH Final Report
William C. Mann Feb. 1977 24 p refs
(Contracts N00014-75-C-0710; MDA903-74-C-0289; ARPA Order 2930; NR Proj. 154-374; RR0420601)
(AD-A037108; ISI/RR-77-57) Avail: NTIS HC A02/MF A01 CSCL 05/8

This is the final report of a multifaceted research and development effort in man-machine communication. The general goal of the program is to facilitate existing and future man-machine communication in areas of high military impact, including rapidly expanding use of on-line computing in communications and command and control. Highlights of the accomplishments of this research include: identification of major causes of man-machine communication difficulty for the computer-naive; discovery of major communication structures in human communication that have been left out of man-machine communication; creation of a process model that exhibits these structures in a form which can be imitated directly in creating new man-machine communication processes; creation of a new overview of how human communication functions in cooperative task-oriented activity; and assistance in ARPA policy formation on CAI equipment development. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-25869 British Library Lending Div., Boston Spa (England).
EXPANSION OF DETERMINANTS BY ELEMENTS FROM DIFFERENT COLUMNS (ROWS)
L. P. Afinogenov [1976] 9 p ref Transl. into ENGLISH from Vses. Nauch.-Issled. Inst. Gidromet. Informat. Mirov. Tsent. Danny., T. Vyp. (USSR), v. 12, 1976 p 119-124
(BLL-M-24885-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

A method of expansion, connecting with elements not drawn from a single column (row), e.g. those from a diagonal, is described. It is used as a basis to derive some properties of determinants and of the characteristic equations for matrices of a special type. Author

N77-25870# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Math.
IMPLEMENTATION AND APPLICATION OF A NESTED DECOMPOSITION ALGORITHM
J. K. Ho May 1976 33 p refs Presented at Bicentennial Conf. on Mathematical Programming, Gaithersburg, Md., 29 Nov. 1976
(Contract E(30-1)-16)
(BNL-21396; Conf-761126-1) Avail: NTIS HC A03/MF A01

A nested decomposition algorithm for mulistage linear programs with the staircase structure is considered. Computational aspects of the algorithm essential to an efficient implementation are discussed. Experience with using experimental codes of the algorithm on problems arising from real applications, such as energy models, engineering design, and dynamic traffic control, is presented. It is observed that nested decomposition can be an efficient technique for large-scale systems. ERA

N77-25871# Montpellier Univ. (France). Dept. de Physique Mathematique.
IMPEDANCE, ZERO ENERGY WAVE FUNCTION, AND BOUND STATES
A. Martin (CERN) and P. C. Sabatier Jan. 1977 13 p refs
(PM/77/2) Avail: NTIS HC A02/MF A01

It is shown that the presence, or absence, of bound states in the 3D Schroedinger equation depends on the existence of zeros for a function which is a zero energy solution of the equation and which has the meaning of an impedance in a related transmission line equation. Several inequalities sufficient to prevent the existence of bound states are obtained. Some are new and bridge the gap between p equals 1 and p equals 3/2 in the special case of spherically symmetric potential. ESA

N77-25872# Montpellier Univ. (France). Dept. de Physique Mathematique.
IST-SOLVABLE NONLINEAR EVOLUTION EQUATIONS AND EXISTENCE. AN EXTENSION OF LAX'S METHOD
I. Miodek Dec. 1976 29 p refs
(PM/76/12) Avail: NTIS HC A03/MF A01

An extension of Lax's unitary operator method is presented which permits recovery of the more general nonlinear evolution equations of Ablowitz, Kaup, Newell, and Segur (A.K.N.S.). The extension is based directly on analyticity properties in the energy variable and permits proving the existence of the solutions of the evolution equations associated with the Schroedinger equation. It also permits extending the A.K.N.S. results to n x n matrix equations. Author (ESA)

N77-25873# Montpellier Univ. (France). Dept. de Physique Mathematique.
NONLINEAR EVOLUTION EQUATIONS FOR LINEAR FIRST ORDER n x n MATRIX DIFFERENTIAL EQUATIONS OF THE ZAKHAROV-SHABAT TYPE
I. Miodek Jan. 1977 18 p refs
(PM/77/1) Avail: NTIS HC A02/MF A01

The nonlinear evolution equations contain the evolution equation of Ablowitz, Kaup, Newell, and Segur as the 2 x 2 case. The method developed for the Schroedinger equation in a previous companion paper is used. It is shown that the matrix equation is a standard form for a less restricted class of equations and also that the Schroedinger equation is a true special case of the 2 x 2 matrix case. Author (ESA)

N77-25874# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
CONDITIONAL RECURRING SEQUENCES Ph.D. Thesis - Tech. Hogeschool Delft, Neth.
J. L. Simons 3 Nov. 1975 52 p refs
(NLR-TR-76003-U) Avail: NTIS HC A04/MF A01

The theory of linear recurring sequences is generalized to sequences generated by a set of polynomials. Sequences generated by such a set are called conditional recurring sequences; their properties were investigated. Several examples are given. ESA

N77-25875# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.
THE RELATION BETWEEN SCATTERING MATRIX AND HYBRID MATRICES [DER ZUSAMMENHANG ZWISCHEN STREUMATRIX UND HYBRIDMATRIZEN]
Guenter Morgenstern May 1976 15 p refs In GERMAN
(IND-FB-89) Avail: NTIS HC A02/MF A01

The formulas for the scattering matrix as a function of the hybrid matrices are presented. Formulas for the scattering matrix as a function of the immittance matrix and the operational immittance matrix as a special case are included. Examples are given for application to a 3-coil ideal transformer and a hybrid coil. ESA

N77-25876# European Space Agency, Paris (France).
NONLINEAR, TRANSFORMATION MATRIX OF THE ELONGATED, BENT AND TWISTED ROD
Dieter Petersen May 1977 25 p ref Transl. into ENGLISH of 'Nichtlineare Transformationsmatrix fuer den gedehnten, gebogenen u. tordierten Stab', DFVLR, Brunswick Report DLR-FB-76-62, 19 Nov. 1976 Original report in GERMAN previously announced as N77-21914 Original German report available from DFVLR, Cologne DM 12.20
(ESA-TT-379; DLR-FB-76-62) Avail: NTIS HC A02/MF A01

The nonlinear transformation matrix between a reference system of coordinates and the coordinate system of a deformed rod which is fixed to the main axes of the cross section was established. If the geometrical nonlinearities in the case of bending in both directions which is variable along the length of the beam are taken into account, a nonlinear integral of deformation terms has to be solved. Thus, the determination of the initial value sometimes is difficult. The nonlinear approach for a rod with variable extension, bending, and twisting along its length is discussed, and the solution including terms of third order is given. Author (ESA)

N77-25877# Harvard Univ., Cambridge, Mass.
THE GENESIS OF DYNAMIC SYSTEMS GOVERNED BY METZLER MATRICES
Kenneth J. Arrow Dec. 1976 19 p refs
(Contract N00014-67-A-0298-0019)
(AD-A036140; TR-29) Avail: NTIS HC A02/MF A01 CSCL 05/3

This paper studies the behavior in the neighborhood of the starting point of dynamic systems (solutions of difference or differential equations) whose Jacobians are Metzler matrices. (A Metzler matrix is one whose off-diagonal elements are non-negative.) A new concept, that of first-positivity of a sequence, is introduced; a sequence is first-positive if its first non-zero element is positive. First-positivity holds for a sequence of matrices or vectors if it holds for each component. It is shown that the sequence of powers of a Metzler matrix is first-positive; also, for each position in the matrix (defined by row and column), the number of steps to the first non-zero entry in the sequence is equal to the minimum length of a chain from the row to the column through non-zero entries in the Metzler matrix. From this, it is possible to express (a) the time of first-positivity of a specific component of the solution to a system of difference equations and (b) the order of increase of a specific component of the solution to a system of differential equations in terms of the connectivity properties of the governing matrix, the specification of the positive components of the starting values, and the first-positivity properties of the forcing functions. Author (GRA)

N77-25878# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
SENSITIVITY OF MINQUE WITH RESPECT TO A PRIORI WEIGHTS Interim Report
James L. Hess 1977 17 p refs
(Grant AF-AFOSR-2871-75; AF Proj. 2304)
(AD-A035696; AFOSR-77-0062TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper shows that for the a priori weights in a neighborhood of the ratio of the variance components the variances of the minque are quite insensitive. That is, the variances deviate little from the optimum variances. GRA

N77-25879# Naval Surface Weapons Center, White Oak, Md.
A NOTE ON THE OPERATOR COMPACT IMPLICIT METHOD FOR THE WAVE EQUATION
Melvyn Ciment and Stephen H. Leventhal 16 Nov. 1976 16 p refs
(ZR0140201)
(AD-A035443; NSWC/WOL/TR-76-153) Avail: NTIS HC A02/MF A01 CSCL 12/1

In a previous paper a fourth order compact implicit scheme was presented for the second order wave equation. A very efficient factorization technique was developed when only second order terms were present. In this note we implement the operator compact implicit spatial discretization method for the second order wave equation when first order terms are present. The resulting algorithm is completely analogous to the compact implicit algorithm when lower order terms were not present. For this more general operator compact implicit spatial approximation the same factorization as in our previous paper is developed. Author (GRA)

N77-25880# Minnesota Univ., Minneapolis. Dept. of Theoretical Statistics.
ASYMPTOTIC EXPANSIONS OF THE DISTRIBUTIONS OF SOME CLASSIFICATION STATISTICS AND THE PROBABILITIES OF MISCLASSIFICATION WHEN THE TRAINING SAMPLES ARE DEPENDENT
Somesh DasGupta and Shibdas Bandyopadhyav (Calif. Univ., Davis) 22 Jan. 1976 27 p refs
(Grant DAAG29-76-G-0038)
(AD-A035049; TR-260; ARO-13149.2-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

Asymptotic expansions of the distributions of some classification statistics and associated probabilities of misclassification are considered for a two population classification problem when the population distributions follow a stationary Gaussian process. Special cases have been considered when the population distributions follow a first order autoregressive process and, in particular, the probabilities of misclassification is studied as a function of the measure of dependence between the two populations. Author (GRA)

N77-25881# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CONVEX INTERPOLATION OF CONVEX DATA
Walter O. Egerland Jan. 1977 11 p refs
(AD-A035070; BRL-1952) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report contains the mathematical basis of an interpolation technique that constructs a smooth convex interpolant, called an H-Spline, for convex data on the real line. It is shown that an H-Spline always exists and is unique. Author (GRA)

N77-25882# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
A SEMI-FAST FOURIER TRANSFORM ALGORITHM OVER GF (2 TO THE MTH POWER)
Dilip V. Sarwate Sep. 1976 26 p refs
(Contract DAAB07-72-C-0259)
(AD-A034982; UILU-ENG-76-2223; R-735) Avail: NTIS HC A03/MF A01 CSCL 12/1

An algorithm which computes the Fourier Transform of a sequence of length n over GF (2 to the mth power) using approximately 2nm multiplications and n squared nm additions is developed. The number of multiplications is thus considerably smaller than the n squared multiplications required for a direct evaluation, though the number of additions is somewhat larger. Unlike the Fast Fourier Transform, this method does not depend on the factors of n and can be used when n is not highly

composite or is a prime. The bit complexity of the algorithm is analyzed in detail. Implementations and applications are briefly discussed. Author (GRA)

N77-25883# Princeton Univ., N. J. Dept. of Chemical Engineering.
NUMERICAL SOLUTION OF STIFF ORDINARY DIFFERENTIAL EQUATIONS Final Report, 1 May 1974 - 30 Nov. 1976
Leon Lapidus 31 Jan. 1977 13 p refs
(Grants DAHC04-74-G-0158; DAHC04-75-G-0138)
(AD-A036176; ARO-12232.1-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

An analysis is presented for alternate numerical techniques for solving stiff ordinary differential equations. These techniques include a singular perturbation or pseudo-steady-state method and an imbedded, error-monitoring semi-implicit Runge-Kutta method. Extensive numerical experience on equations which are linear/nonlinear, small/large dimensional, and moderately/strongly stiff reveals that the singular perturbation method is most efficient for very stiff problems while the imbedded Runge-Kutta method is superb over a wide range of stiffness. Author (GRA)

N77-25884# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
OPTIMAL RADIUS OF CONVERGENCE OF INTERPOLATORY ITERATIONS FOR OPERATOR EQUATIONS Interim Report
J. F. Traub and H. Wozniakowski Nov. 1976 23 p refs
(Contract N00014-76-C-0370)
(AD-A035903) Avail: NTIS HC A02/MF A01 CSCL 12/1

The convergence of the class of direct interpolatory iterations I sub n for a simple zero of a non-linear operator F in a Banach space of finite or infinite dimension is studied. A general convergence result is established and used to show that if F is entire the radius of convergence goes to infinity with n while if F is analytic in a ball of radius of convergence increases to at least R/2 with n. Author (GRA)

N77-25885# Air Force Academy, Colo. Frank J. Seiler Research Lab.
MINIMUM DISTANCE LEAST SQUARES SURFACE FITTING
Armand A. Fannin, Jr. and Lowell A. King Dec. 1976 49 p refs
(AD-A035485; FJSRL-TR-76-0019) Avail: NTIS HC A03/MF A01 CSCL 12/1

A least squares fitting technique is described where all of the experimental variables are considered subject to error, rather than the customary single variable. The procedure is particularly valuable when the actual physical measurements contain real and estimable errors in more than one variable. The fitting procedure minimizes the closest perpendicular distance from the experimental point to the locus on the assumed functional relationship among the n different variables. The locus is approximated by a (n-1) dimensional surface. The technique is adaptable to any number of variables and any number of adjustable constants in the assumed equation. GRA

N77-25886# Navy Personnel Research and Development Center, San Diego, Calif.
FACTOR REGRESSION ANALYSIS: A NEW METHOD FOR WEIGHTING PREDICTORS Final Report, 1 Jul. 1971 - 31 Aug. 1976
Ervin W. Curtis Dec. 1976 39 p refs
(RR0420401)
(AD-A035441) Avail: NTIS HC A03/MF A01 CSCL 12/1

The optimum weighting of variables to predict a dependent/criterion variable is an important problem in nearly all of the social and natural sciences. Although the predominant method multiple regression analysis (MR), yields optimum weights for the sample at hand, these weights are not generally optimum in the population from which the sample was drawn. A method was developed that sacrifices some 'prediction' in the sample at hand in order to achieve a more reliable and stable predictor composite. The method developed, Factor Regression Analysis (FRA), is based on the first principle component of the predictor intercorrelation matrix with validities in the diagonal cells. FRA yielded very stable predictor composites and weights--the weights themselves varied less from sample to sample than did MR weights from the same samples. These differences were marked for low sample sizes (e.g., $N < 25$), regardless of the number of variables in regression. With regard to prediction, FRA composites were substantially more valid in the population than the MR composites based on the same samples. The number of predictors in the subset did not turn out to be very important. FRA weights based on samples of 25 were about as valid as MR weights based on samples of 100. With samples of 200 the two methods yielded roughly equivalent prediction. Author (GRA)

N77-25887# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
COMPUTATIONAL COMPLEXITY OF ONE-STEP METHODS FOR SYSTEMS OF DIFFERENTIAL EQUATIONS Interim Report
Arthur G. Werschulz Sep. 1976 36 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-222-55; NR Proj. 044-022)
(AD-A035929) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem is to calculate an approximate solution of an initial value problem for an autonomous system of N ordinary differential equations. Using fast power series techniques, we exhibit an algorithm for the pth-order Taylor series method requiring only Op to the N power LN P arithmetic operations per step as p goes to plus infinity. Moreover, we show that any such algorithm requires at least Op to the N power Operations per step. We compute the order which minimizes the complexity bounds for Taylor series and linear Runge-Kutta methods, and show that in all cases, this optimal order increases as the error criterion epsilon decreases, tending to infinity as epsilon tends to zero. Finally, we show that if certain derivatives are easy to evaluate, then Taylor series methods are asymptotically better than linear Runge-Kutta methods for problems of small dimension N. Author (GRA)

N77-25888# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
COMPUTATIONAL COMPLEXITY OF ONE-STEP METHODS FOR A SCALAR AUTONOMOUS DIFFERENTIAL EQUATION Interim Report
Arthur G. Werschulz Sep. 1976 26 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-222-55)
(AD-A035930) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem is to calculate an approximate solution of an initial value problem for a scalar autonomous differential equation. A generalized notion of a nonlinear Runge-Kutta NRK method is defined. We show that the order of any s-stage NRK method cannot exceed 2s-1 hence, the family of NRK methods due to Brent has the maximal order possible. Using this result, we derive complexity bounds on the problems of finding an approximate solution with error not exceeding epsilon. We also compute the order which minimizes these bounds, and show that this optimal order increases as epsilon decreases, tending to infinity as epsilon tends to zero. Author (GRA)

N77-25889# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
OPTIMAL ORDER AND MINIMAL COMPLEXITY OF ONE-STEP METHODS FOR INITIAL VALUE PROBLEMS Interim Report
Arthur G. Werschulz Sep. 1976 40 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-222-55; NR Proj. 044-422)
(AD-A035931) Avail: NTIS HC A03/MF A01 CSCL 12/1

We consider the task of numerically approximating the solution of an ordinary differential equation initial value problem. A methodology is given for determining the computational complexity of finding an approximate solution with error not exceeding epsilon. In addition, we determine the method of optimal order within a given class of methods, and show that under reasonable hypotheses, the optimal order increases as epsilon decreases, tending to infinity as epsilon tends to zero. Author (GRA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-25890*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

VARIATIONAL ALGORITHMS FOR NONLINEAR SMOOTHING APPLICATIONS

Ralph E. Bach, Jr. (Northwestern Univ., Boston) Jun. 1977 37 p refs

(NASA-TM-X-73211; A-6939) Avail: NTIS HC A03/MF A01 CSCL 12A

A variational approach is presented for solving a nonlinear, fixed-interval smoothing problem with application to offline processing of noisy data for trajectory reconstruction and parameter estimation. The nonlinear problem is solved as a sequence of linear two-point boundary value problems. Second-order convergence properties are demonstrated. Algorithms for both continuous and discrete versions of the problem are given, and example solutions are provided. Author

N77-25891# Purdue Univ., Lafayette, Ind. Dept. of Statistics.

SOLVING QUEUES WITHOUT ROUCHE'S THEOREM

Marcel F. Neuts Oct. 1976 31 p refs Prepared in cooperation with Delaware Univ., Newark

(Grant AF-AFOSR-2350-72; AF Proj. 2304)

(AD-A035362; AFOSR-77-0025TR) Avail: NTIS HC A03/MF A01 CSCL 12/2

An analysis of the steady-state probabilities of a class of infinite Markov chains is given. Markov chains of this type appear in the study of bulk queues and a variety of other stochastic models. Algorithms, which involve only real arithmetic and avoid the traditional analysis, based on Rouche's theorem, are presented. GRA

N77-25892# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.

A CLASS OF LANCHESTER ATTRITION PROCESSES Final Report

Alan F. Karr Dec. 1976 44 p refs

(AD-A035274; P-1230; IDA/HQ-76-18674) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper derives from physical assumptions a class of stochastic attrition processes, some of which are analogous to the deterministic models of F. Lanchester. Shooting weapons are classified as having independent or proportional engagement initiation and as being single-kill or multiple kill. Several special cases of the generalized process are examined in detail and related to previous attrition models. Computational problems, fire allocation, and some related phenomena are also treated. GRA

N77-25893# Letterman Army Inst. of Research, San Francisco, Calif.

GENERALIZED RESEARCH ANALYSIS STATISTICAL SYSTEM. SECOND EDITION (DECEMBER 1974) Final Report

Henry Lazarus, Tom McCaa, Richard Teplick, and Margaret Wrensch Nov. 1976 154 p refs

(DA Proj. 3A7-62760-A-822)

(AD-A035754; LAIR-33) Avail: NTIS HC A08/MF A01 CSCL 12/1

This report describes an automated Generalized Research Analysis Statistical System (GRASS) which is easy to use and which will satisfy many of the statistical compuatational requirements of laboratory investigators. Instructions are given for utilization of this system in a manner sufficiently detailed to be usable by personnel unfamiliar with computer operations. Author (GRA)

N77-25894# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A MONTE CARLO STUDY OF COMPOSITE SEQUENTIAL LIKELIHOOD RATIO TESTS FOR THE WEIBULL SCALE PARAMETER M.S. Thesis

Richard L. Hoffert Dec. 1976 98 p refs

(AD-A035458; GOR/MA/76-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

Three Sequential Likelihood Ratio Tests were constructed to choose between two values of the scale parameter (THETA) of a Weibull distribution with a location parameter of zero, an unknown shape parameter K replaced by its maximum likelihood estimate, and error bounds of 0.05, 0.10, 0.15, and 0.20. The first two tests were based upon a general procedure for sequential tests for a parameter in the presence of a nuisance parameter by D. R. Cox in Sankhya A, Vol. 25. This method replaces the likelihood ratio with an asymptotically equivalent test statistic. The tests were then truncated and the effects of this truncation upon the error bounds were studied. GRA

N77-25895# Texas Univ., Austin. Electronics Research Center.

NONPARAMETRIC ESTIMATION WITH LOCAL RULES

C. S. Penrod and T. J. Wagner 11 Oct. 1976 111 p refs

(Contract F44620-76-C-0089)

(AD-A035145; TR-182; AFOSR-77-0019TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

An attempt was made to identify the questions which are of genuine importance to a statistician who is interested in evaluating nonparametric estimation rules. The asymptotic performance of various nearest neighbor rules and loss functions was analyzed, and the results concerning the convergence of the conditional risk are quite strong considering the simple nature of the rules and the minimal assumptions made concerning the problem structure. In addition, distribution-free bounds on the error of two different estimates of finite sample performance are derived for a class of estimation rules which include k-nearest neighbor rules. For comparison purposes, a simulation study was carried out so that the bounds for a few specific distributions could be compared with the theoretical bounds. GRA

N77-25896# Minnesota Univ., Minneapolis. Dept. of Theoretical Statistics.

ON SOME ASPECTS OF THE CLASSIFICATION PROBLEM

Hsien Elsa Lin Oct. 1976 122 p refs

(Grant DAAG29-76-G-0038)

(AD-A035041; TR-276; ARO-13149.1-M) Avail: NTIS HC A06/MF A01 CSCL 12/1

Different rules for the problem of classifying one (or more) unit to one of several distinct populations on the basis of random training samples are considered and their asymptotic probabilities of misclassification (PMC) are derived. GRA

N77-25897# Minnesota Univ., Minneapolis. Dept. of Theoretical Statistics.

SOME PROBLEMS IN STATISTICAL PATTERN RECOGNITION

Somesh DasGupta 20 Jan. 1976 26 p refs

(Grant DAAG29-76-G-0038)

(AD-A035048; TR-258; ARO-13149.3-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

A review along with criticism of some recent work on nonparametric and sequential rules in statistical pattern recognition is given in this paper. Some new results and directions for future work are also discussed. Author (GRA)

N77-25898# Aberdeen Univ. (Scotland).

ENUMERATION OF LARGE COMBINATORIAL STRUCTURES Annual Technical Report No. 2, Nov. 1975 - Nov. 1976

E. M. Wright Nov. 1976 91 p refs

(Grant DA-ERO-75-G-014; DA Proj. 1T1-61102-B-18C)

(AD-A035777) Avail: NTIS HC A05/MF A01 CSCL 12/1

Two methods are described to determine exact formulae for the number of labelled connected graphs on n points and n + K edges for general n and different values of K. One method supplies an essential piece of information for general k given this, the other is much more efficient and is well-adapted to machine computation. The first method is extended to several other problems but has to replace the second by a different method for each problem. According to Temperley, at least two of the problems are of physical interest. In addition three problems were solved about the properties and the evolution of almost all large graphs. The appendices consist of six research papers,

of these one contains computer results connected with these problems. GRA

N77-25899# Rice Univ., Houston, Tex. Dept. of Electrical Engineering.
SOME NEW PERFORMANCE CRITERIA IN ROBUST STATISTICS: SMALL SAMPLE ROBUSTNESS
P. Papantoni-Kazakos Jan. 1977 48 p refs
(Grant AF-AFOSR-3156-77)
(AD-A035355; EE-7701; AFOSR-77-0033TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper the analysis of estimates operating on dependent data is considered. Special dependent data structures are considered and the analysis is made for three different choices of contamination and performance distance measures. For contamination and performance measures both being Levy (Hampel model), an analysis that is particularly oriented toward fast convergence of the estimate to value that is stable (robust) inside the contaminated family is undertaken. The minimum sample size to satisfy certain performance is investigated and it is found that the problem reduces to finding continuous, absolutely bounded estimates with logarithms of their moment generating function slowly increasing with the absolute value of the argument for all data distributions considered. Author (GRA)

N77-25900# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Aeroballistics Directorate.
A PARAMETER ESTIMATION TECHNIQUE FOR THE GENERALIZED RAYLEIGH-RICIAN DISTRIBUTION AND LAHA'S BESSEL DISTRIBUTION
Jerry W. Vickers 8 Dec. 1976 26 p refs
(DA Proj. 1W3-62303-A-214)
(AD-A035080; RD-77-11) Avail: NTIS HC A03/MF A01 CSCL 12/1

The purpose of this report is to provide a means by which the parameters of the generalized Rayleigh distribution can be estimated from experimental data. This report is an outgrowth of research in the area of laser radar technology; however, the results should be of general interest and find application in other disciplines where the generalized Rayleigh distribution is encountered. GRA

N77-25901# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
SEQUENTIAL PROBABILITY RATIO TESTS OF THE SCALE PARAMETER BETWEEN TWO WEIBULL DISTRIBUTIONS WITH KNOWN SHAPE PARAMETER M.S. Thesis
James Norris Robinson Dec. 1976 315 p refs
(AD-A034999; GOR/MA/76D-2) Avail: NTIS HC A14/MF A01 CSCL 12/1

Three types of Weibull sequential probability ratio tests between specified scale parameters are examined when the shape parameter of the distribution is assumed known. The three types of testing are: one test unit tested at a time with replacement on failure, n units on test without replacement dependent sample, and n' units on test with replacement on failure. A new test statistic is presented for the third type. Truncated test plans representing 40 possible shape parameters ranging from .50 to 5.70 are presented for four sets of designated risks. Designated risks for equal Type I and Type II errors are 0.5, .10, .20, and .30. Monte Carlo computer simulations are used to evaluate the test plans in terms of actual risks and actual expected time and failure number to decision under H0 and Ha. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N77-25902# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Uebertragungstechnik.
RELATION BETWEEN THE SIGNAL FLOW MATRIX AND THE CHARACTERISTIC POLYNOMIAL OF A TIME-DISCRETE SYSTEM [UEBER DEN ZUSAMMENHANG ZWISCHEN SIGNALFLUSSMATRIX UND CHARAKTERISTISCHEM POLYNOM EINES ZEITDISKRETEN SYSTEMS]
Raimund Luecker Sep. 1976 14 p refs In GERMAN
(IND-FB-93) Avail: NTIS HC A02/MF A01

The structure and behavior of a time-discrete system is described by a signal flow matrix, derived from the theory of signal flow graphs. The relation between this matrix representation and the characteristic polynomial of a network is indicated. ESA

N77-25903# Grumman Aerospace Corp., Bethpage, N.Y.
EXPERIMENTAL VALIDATION OF AN OPTIONS SELECTION MATRIX AND INVESTIGATION OF OTHER DISPLAY FORMATS AS OPERATIONAL DECISION AIDS Technical Report, 1 Jul. 1976 - 31 Jan. 1977
C. R. Kalenty, W. L. Lockwood, and V. M. Vissering, Jr. Feb. 1977 107 p
(Contract N00014-76-C-0879)
(AD-A035755; CSS-77-1) Avail: NTIS HC A06/MF A01 CSCL 12/2

This study was conducted to: (1) continue work previously started for further evaluation of an options selection matrix, and (2) investigate the development of other display formats as aids for decisions which are not adequately supported by the options matrix. Options matrix validation involved the design of an experiment in which potential operational users, represented by twelve senior officers, both active duty and retired, were used as subjects. Their comments and recommendations as to the operational potential of the options matrix were solicited and are documented herein. In the development of other display formats, two decision points, i.e., selection of an operations area and selection of a transit route, were investigated. These decisions were examined to determine the types of data required to arrive at a decision, the means of displaying a variety of detailed information, and a way to present the data in a synoptic form which would both include all the data, and provide the commander with a concise display of the data pertinent to his decision. Author (GRA)

N77-25904# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
THE INCOMPLETE DIRICHLET'S MULTIPLE INTEGRAL
B. D. Sivazlian Nov. 1976 29 p refs
(Contract DAHC04-75-C-0150)
(AD-A035572; RR-76-24; ARO-12640.16-M) Avail: NTIS HC A03/MF A01 CSCL 12/2

It is shown that this integral is reducible to a single integral involving products of incomplete beta functions as a multiplicative constant. The results are generalized and extended to other multiple integrals. Finally, as an application, a class of multivariate type distribution defined by a functional form is partially investigated. Author (GRA)

N77-25905# Texas Univ., Austin. Center for Cybernetic Studies.
SOLVING SINGULARLY CONSTRAINED GENERALIZED NETWORK PROBLEMS
John Hultz and Darwin Klingman Sep. 1976 36 p refs
(Contracts N00014-75-C-0616; N00014-75-C-0569; N00014-76-C-0383)
(AD-A035917; CCS-256) Avail: NTIS HC A03/MF A01 CSCL 12/2

The singularly constrained generalized network problem represents a large class of capacitated linear programming (LP) problems. This class includes any LP problem whose coefficient matrix, ignoring single upper bound constraints, contains m 1 rows which may be ordered such that each column has at most two non-zero entries in the first m rows. The paper describes efficient procedures for solving such problems and presents computational results which indicate that procedures are at least five times faster than the state of the art LP systems MPS-360 and Apex-3. GRA

N77-25906# Texas Univ., Austin. Center for Cybernetic Studies.
SOLVING CONSTRAINED GENERALIZED NETWORK PROBLEMS
John Hultz and Darwin Klingman Nov. 1976 25 p refs
(Contracts N00014-75-C-0616; N00014-75-C-0569; N00014-76-C-0383)

(AD-A035918; CCS-257) Avail: NTIS HC A02/MF A01 CSCL 12/2

A constrained generalized network problem is a linear programming problem in which the coefficient matrix contains M&Q rows which are ordered such that each column has at most two non-zero entries in the first m rows. This paper describes highly efficient ways to modify and implement the steps of the simplex algorithm for such problems. The efficiency is the direct result of exploiting the generalized network portion First m rows of the coefficient matrix. GRA

N77-25907# Naval Postgraduate School, Monterey, Calif.
AN ALGORITHM FOR SOLVING A RANGE CONSTRAINED TRAVELING SALESMAN PROBLEM M.S. Thesis
John William Harms Dec. 1976 50 p refs
(AD-A035842) Avail: NTIS HC A03/MF A01 CSCL 12/2

A problem of routing earth resource survey aircraft, proposed by NASA, is formulated as a traveling salesman problem, in which the salesman (aircraft) has a range constraint. A heuristic algorithm is presented, which seeks a minimal length set of subtours through n cities. The aircraft begins a subtour at the base location, visits a subset of the n cities and returns when the range constraint prevents a visit to another city. Additional subtours are created until all cities are visited. The algorithm is programmed in FORTRAN for use on digital computers. The IBM-360/67 computer at the Naval Postgraduate School was used to fine solutions to three operational problems of size seven, eighteen and twenty-five cities. Computation times for each problem was under 20 seconds and the solutions were significantly better than feasible solutions calculated without the use of the algorithm. Author (GRA)

N77-25908# Army Aviation Systems Command, St. Louis, Mo. Systems Analysis Office.
OPERATIONS RESEARCH/SYSTEMS ANALYSIS APPLICATIONS Final Report
Blaine T. Stone and Mark E. Barkley Feb. 1977 33 p refs
(AD-A035814; DRSAV-d-77-3; USAAVSCOM-TR-77-4) Avail: NTIS HC A03/MF A01 CSCL 12/2

This paper presents an overview of operations research and systems analysis, the typical role of a U.S. Army operations research/systems analysis organization, and an operations research/systems analysis applications matrix showing a number of the projects accomplished by the Systems Analysis Office, U.S. Army Aviation Systems Command. Additionally, a list of abbreviations and acronyms, and a glossary of term germane to U.S. Army operations research/systems analysis are included. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N77-25909*# Kanner (Leo) Associates, Redwood City, Calif.
GEOMETRIZATION OF THE DIRAC THEORY OF THE ELECTRON
V. Fock Washington NASA Jun. 1977 28 p refs Transl. into ENGISH from Z. fuer Physik. (Berlin), v. 57, 1929 p 261-277
(Contract NASw-2790)
(NASA-TM-75127) Avail: NTIS HC A03/MF A01 CSCL 12/1

Using the concept of parallel displacement of a half vector, the Dirac equations are generally written in invariant form. The energy tensor is formed and both the macroscopic and quantum mechanic equations of motion are set up. The former have the usual form: divergence of the energy tensor equals the Lorentz force and the latter are essentially identical with those of the geodesic line. Author

N77-25910# Harvard Univ., Cambridge, Mass.
MANIFOLDS OF PREFERENCES AND EQUILIBRIA
Graciela Chichilnisky Oct. 1976 93 p refs
(Contract N00014-67-A-0298-0019; Grant NSF GS-18174)
(AD-A036138; TR-27) Avail: NTIS HC A05/MF A01 CSCL 12/1

Local and global properties of spaces of preferences are studied, with applications to general equilibrium, utility and demand analysis. Spaces of smooth, not necessarily convex or increasing preferences are proven to be representable as differentiable Hilbert manifolds. These structures of spaces of preferences are then used to extend results on the regularity of equilibria to economies where the agents are described by their preferences and endowments. Subspaces of preferences which give foliations of the commodity space and also subspaces of convex and increasing smooth preferences are shown to be submanifolds. Topological properties of these manifolds, and local and global properties of the demands and the utilities of the agents in relation to the underlying preferences are also studied. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-25911# Naval Research Lab., Washington, D. C.
NRL VAN DE GRAAFF OPERATION, 1 JANUARY - 31 DECEMBER 1975 Final Report
J. W. Butler Nov. 1976 77 p refs
(AD-A035747; NRL-MR-3421) Avail: NTIS HC A05/MF A01 CSCL 20/7

This document is the eleventh and final report of a series of summaries of the use and development of the NRL5-MVVan de Graaff accelerator and associated equipment. The first six were semiannual summaries, and the next five, including the present one, were annual summaries. The present report includes a section on facility development and improvement, including specific reports on: (1) the development of new species of ion beams from the Van de Graaff, and (2) the construction of a new 200-kV ion implantation system. A section on research highlights includes descriptions of experiments on reactor material neutron damage simulation by heavy-ion bombardment, x-ray emission during bombardment of materials by heavy ions, materials modification by ion implantation, and materials analysis by ion beams. The final section includes brief descriptions of service irradiations for scientists outside the branch. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N77-25912*# DyTec Engineering, Inc., Huntington Beach, Calif.
RECOMMENDED PROCEDURES FOR MEASURING AIRCRAFT NOISE AND ASSOCIATED PARAMETERS
Alan H. Marsh Apr. 1977 164 p refs
(Contract NAS1-12436)
(NASA-CR-145187; DyTec-R-0176) Avail: NTIS HC A08/MF A01 CSCL 20A

Procedures are recommended for obtaining experimental values of aircraft flyover noise levels (and associated parameters). Specific recommendations are made for test criteria, instrumentation performance requirements, data-acquisition procedures, and test operations. The recommendations are based on state-of-the-art measurement capabilities available in 1976 and are consistent with the measurement objectives of the NASA Aircraft Noise Prediction Program. The recommendations are applicable to measurements of the noise produced by an airplane flying subsonically over (or past) microphones located near the surface of the ground. Aircraft types covered by the recommendations are fixed-wing airplanes powered by turbojet or turbofan engines and using conventional aerodynamic means for takeoff and landing. Various assumptions with respect to subsequent data processing and analysis were made (and are described) and the recommended measurement procedures are compatible with the assumptions. Some areas where additional research is

needed relative to aircraft flyover noise measurement techniques are also discussed. Author

N77-25913*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE REDUCTION EVALUATION OF GRIDS IN A SUPERSONIC AIR STREAM WITH APPLICATION TO SPACE SHUTTLE
John M. Seiner, James C. Manning, Paul Nystrom, and S. Paul Pao May 1977 36 p refs
(NASA-TM-X-74034; Rept-2620) Avail: NTIS HC A03/MF A01 CSCL 20A

Near field acoustic measurements were obtained for a model supersonic air jet perturbed by a screen. Noise reduction potential in the vicinity of the space shuttle vehicle during ground launch when the rocket exhaust flow is perturbed by a grid was determined. Both 10 and 12 mesh screens were utilized for this experiment, and each exhibited a noise reduction only at very low frequencies in the near field forward arc. A power spectrum analysis revealed that a modest reduction of from 3 to 5 decibels exists below a Strouhal number S sub t = 0.11. Above S sub t = 0.11 screen harmonics increased the observed sound pressure level. The favorable noise reductions obtained with screens for S sub t < 0.11 may be of substantial interest for the space shuttle at ground launch. Author

N77-25914*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
TRANSMISSION OF SOUND THROUGH NONUNIFORM CIRCULAR DUCTS WITH COMPRESSIBLE MEAN FLOWS
A. H. Nayfeh, B. S. Shaker, and J. E. Kaiser May 1977 66 p refs
(Contract NAS1-13884)
(NASA-CR-145126; VPI-E-77-2) Avail: NTIS HC A04/MF A01 CSCL 20A

An acoustic theory is developed to determine the sound transmission and attenuation through an infinite, hard-walled or lined, circular duct carrying compressible, sheared, mean flows and having a variable cross section. The theory is applicable to large as well as small axial variations, as long as the mean flow does not separate. Although the theory is described for circular ducts, it is applicable to other duct configurations - annular, two dimensional, and rectangular. The theory is described for the linear problem, but the technique is general and has the advantage of being applicable to the nonlinear case as well as the linear case. The technique is based on solving for the envelopes of the quasi-parallel acoustic modes that exist in the duct instead of solving for the actual wave. A computer program was developed. The mean flow model consists of a one dimensional flow in the core and a quarter-sine profile in the boundary layer. Results are presented for the reflection and transmission coefficients in ducts with varying slopes and carrying different mean flows. Author

N77-25915*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A REVIEW OF CURRENT PROCEDURES FOR NORMALIZING AIRCRAFT FLYOVER NOISE DATA TO REFERENCE METEOROLOGICAL CONDITIONS
Richard DeLoach Washington May 1977 14 p refs
(NASA-TN-D-8406; L-10471) Avail: NTIS HC A02/MF A01 CSCL 20A

Procedures that are currently used to normalize raw aircraft noise data to reference weather conditions are reviewed. These procedures sometimes result in calculated values of molecular absorption which differ from measured values, especially at higher frequencies. An explanation is offered for this discrepancy, and its effect on normalized sound levels and on calculations of effective perceived noise level is examined. Author

N77-25916# Technische Hochschule, Aachen (West Germany). Inst. feur Luft- und Raumfahrt.
NOISE FROM THE INTERACTION OF EXHAUST FLOWS AND TANGENTIALLY BLOWN WINGS AND FLAPS
G. Neuwerth, E. Evertz, and V. Kloppel 1976 17 p refs
Avail: NTIS HC A02/MF A01

On the basis of experimental results the strong noise generation originating from the interference between air jets of high subsonic speed and externally blown flaps (EBF) is discussed. It is shown that, in an undisturbed free jet as well as in a jet deflected by EBF, there are ordered turbulence structures. In addition, both the undisturbed free jet and the jet deflected by EBF have their maximum noise level at the Strouhal number of the natural ordered structures; the difference of the noise levels of both cases have their maximum at this Strouhal number. This explains the great significance of the natural ordered turbulence structures for jet noise caused by interference.
Author (ESA)

N77-25917# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abt. Theoretische Gasdynamik.
SOUND ATTENUATION IN MULTIPLY LINED RECTANGULAR DUCTS INCLUDING EFFECTS OF THE WALL IMPEDANCE DISCONTINUITIES. PART 2: LINERS IN PARALLEL
Werner Koch 11 Nov. 1976 42 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-399)
(DLR-FB-76-58) Avail: NTIS HC A03/MF A01; DFVLR, Cologne, DM 21,60

The problem of sound attenuation by a combination of two acoustic liners of finite length and of different wall impedance on opposite walls in an infinitely long rectangular duct was formulated as a Wiener-Hopf problem for zero mean flow. A coupled system of two generalized Wiener-Hopf equations was obtained and solved. Numerical results are given for a realistic wall impedance model. The influence of several liner parameters on sound attenuation is displayed graphically. It is shown that a combination of liners in parallel (as well as liners in series) is an efficient means of obtaining broad band attenuation.
Author (ESA)

N77-25918# National Bureau of Standards, Washington, D. C. Applied Acoustics Section.
THE NATIONAL MEASUREMENT SYSTEM FOR ACOUSTICS
David S. Pallett and Marilyn A. Cadoff Mar. 1977 94 p refs
(PB-264290/8; NBSIR-75-938) Avail: NTIS HC A05/MF A01 CSCL 14B

Acoustical measurement processes are described which are motivated by societal concern over noise and which have broad relevance to our contemporary technological society. The emphasis of this study of the National Measurement System for Acoustics is to review the status of the system in order to determine the adequacy of these important physical measurements and to promote improvements within the measurement system. The relevant physical quantities are indicated, and the interactions occurring between participants as well as the roles of acoustical standardization institutions are specified. Technological, social and economic impacts are outlined. Finally, the status and trends of the system and the NBS role in adapting to changing technology are discussed. GRA

N77-25919# Wagner (Daniel H.) Associates, Paoli, Pa.
AMBIENT NOISE EFFECTS IN THE MODELING OF DETECTION BY A FIELD OF SENSORS Final Report
Bernard J. McCabe 5 Nov. 1976 55 p refs
(Contract N00014-76-C-0637; NR Proj. 274-254)
(AD-A035358) Avail: NTIS HC A04/MF A01 CSCL 17/1

This report describes a mathematical model for the ambient noise in the ocean caused by merchant ships. This kind of noise dominates in a frequency range in which many initial detections are made by modern sonar equipment and hence an understanding of it is of considerable interest. A stochastic model for ambient noise is defined and its main properties are explored. The ambient noise process is a function both of time and of space, and it is shown to be a stationary stochastic process as a function of either of these variables. Its characteristic function is calculated as are its first two moments. It is shown that the ambient noise process as a function of time has approximately an exponential autocovariance function and it may be satisfactorily modeled as a Gauss-Markov process. Further, it is shown that the correlation between the ambient noise at two points depends to a good approximation only on the propagation loss function and on the distance between these two points (and not materially

on the density or loudness of the noise field). Finally, an effective and practical method for modeling the multidimensional detection process is presented. Author (GRA)

N77-25920# Stanford Univ., Calif. Edward L. Ginzton Lab.
GEOMETRICAL ACOUSTICS AT MICROWAVE FREQUENCIES Final Report, 1 Nov. 1974 - 30 Sep. 1976
Dec. 1976 25 p refs
(Contract N00014-75-C-0359)
(AD-A033779; GL-2644) Avail: NTIS HC A02/MF A01 CSCL 20/1

This project has involved a broad investigation of the propagation characteristics of acoustic waves in inhomogeneous anisotropic media, with special emphasis on focusing and beam steering and an evaluation of potential device applications of the phenomena. Attention was directed particularly at the possibilities for realizing electronically-controlled focusing and scanning of acoustic beams, functions of interest in applications such as acoustic spectrometry and acoustic imaging. GRA

N77-25921# United Technologies Research Center, East Hartford, Conn.
PROGRAMMABLE PSK CORRELATIONS UTILIZING NONLINEAR SAW DELAY LINES Final Technical Report, 7 Apr. 1975 - 31 Jul. 1976
Thomas W. Grudkowski and Thomas M. Reeder Oct. 1976 98 p refs
(Contract N00014-75-C-0978)
(AD-A034979; UTRC/R76-922275-3) Avail: NTIS HC A05/MF A01 CSCL 20/1

This report describes an experimental and theoretical study of nonlinear tapped delay lines, for use in electronically programmable, long code Phase Shift Key (PSK) signal correlation and encoding. The programmable delay line device studied here, which is called the PSK Diode Correlator, is a hybrid, Integrated Circuit device which utilizes a Surface Acoustic Wave (SAW) tapped delay line and an attached microelectronic diode and resistor array. PSK signal processing is accomplished at the P diodetaps of the signal processing region of the device by a low power, wide bandwidth, nonlinear mixing process. The design, fabrication, and testing of 64 and 128 tap devices are described which utilize lithium niobate delay lines and silicon on sapphire diode and resistor arrays. These devices operate with signal and output frequencies near 70 and 30 MHz respectively and have delay line tap spacing chosen for processing PSK sequences with chip rates equal to, or a multiple of 9.8 MHz. The effect of system errors on the correlation response of a multi-module long code PSK cascade processor is analyzed, and the effect of finite module bandwidth is discussed in a simulated 8 module, 1024 chip cascade correlator. GRA

N77-25922# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DEVICES Quarterly Report, 30 Jul. - 31 Oct. 1976
A. R. Janus, R. J. Kolb, and L. Dyal Oct. 1976 31 p
(Contract DAAB07-75-C-0044)
(AD-A035770) Avail: NTIS HC A03/MF A01 CSCL 09/3

The object of the program is the establishment of a production capability for surface acoustic wave devices of varied design and material for the purpose of meeting estimated military needs for a period of two years after the completion of the contract and to establish a base and plans which may be used to meet expanded requirements. The primary requirement is the pilot line production of devices that are reliable, reproducible, and low cost. Fabrication for the 3rd, Confirmatory Phase of the program has been accomplished and environmental testing is nearing completion. Author (GRA)

N77-25923# Naval Postgraduate School, Monterey, Calif.
PREDICTION OF THE FAR-FIELD BEAM PATTERN OF A RANDOM NOISE SOURCE FROM MEASUREMENTS MADE IN THE NEAR-FIELD M.S. Thesis
J. T. Sanchez Dec. 1976 54 p refs
(AD-A035850) Avail: NTIS HC A04/MF A01 CSCL 20/1

A theory is presented for computing the far field beam patterns from distributed random noise sources. The theoretical model uses the Green's Function for the wave equation and the space-time autocorrelation function for determining the radiation from a randomly vibrating area. The actual far field beam pattern of a horn speaker in an anechoic chamber was obtained, and also near field measurements were taken to obtain the correlation distance and the mean square of the particle velocity using the autocorrelation function. Finally a computer program was written to evaluate the integral wave equation by numerical methods. It was found that the critical parameters in the mathematical model were the correlation distance and the frequency limits of integration. Small variations in the correlation distance modified greatly the width of the predicted beam pattern, while changes in the limits of integration had a moderate effect. The Frequency Spectrum was obtained in the anechoic chamber and it was used to determine the limits of integration of the integral solution for the intensity field. GRA

N77-25924# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
CENTRIFUGAL BLOWER NOISE STUDIES LITERATURE SURVEY AND NOISE MEASUREMENTS
G. Krishnappa Dec. 1976 57 p
(AD-A036047; DME-ME-244; NRC-15679) Avail: NTIS HC A04/MF A01 CSCL 13/7

A review of the existing literature on the subject of centrifugal fan and blower noise studies is presented in this report to establish further areas of research needed to aid in the development of a quiet blower. Noise measurements on a wide variety of blowers used in the laboratory, ranging from 1/3 to 700 horsepower are described, with the object of identifying important frequency components from various types of blowers. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-25925*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TABLES OF BRANCHING RATIOS FOR ELECTRIC DIPOLE TRANSITIONS BETWEEN ARBITRARY LEVELS OF HYDROGEN-LIKE ATOMS
K. Omidvar May 1977 26 p refs Submitted for publication
(NASA-TM-X-71320; X-602-77-103) Avail: NTIS HC A03/MF A01 CSCL 20H

The branching ratios in hydrogen-like atoms due to the electric-dipole transitions are tabulated for the initial principal and azimuthal quantum numbers n prime l prime, and final principal and azimuthal quantum numbers n l. Average values with respect to l prime are given. The branching ratios not tabulated, including the initial states n prime yields infinity l prime corresponding to the threshold of the continuum, could be obtained by extrapolation. Author

N77-25926# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTERIZATION OF ATOMIC LEVEL AND TRANSITION DATA FOR THE FIRST AND SECOND IONIZATION STATES OF THE ELEMENTS HYDROGEN THROUGH PHOSPHORUS
E. A. Henry 6 Oct. 1976 15 p refs
(Contract W-7405-eng-48)
(UCRL-52148) Avail: NTIS HC A02/MF A01

A computerized data base of atomic energy levels and atomic transition data was developed from data published by the National Bureau of Standards. These data are of potential use for laser application. The MASTER CONTROL data-base management system is used. ERA

N77-25927# Interuniversitair Reactor Instituut, Delft (Netherlands).
NUMERICAL CALCULATION OF THE RELATIVE DISPLACEMENT OF TWO OPPOSITELY CHARGED SPECIES CARRYING OUT A DIFFUSIVE MOTION IN EACH OTHER'S FIELD. APPLICATION TO THE IONIZATION OF LIQUID HYDRO-

CARBONS BY HIGH ENERGY RADIATION
W. DeZeeuw and A. Hummel [1975] 34 p refs
(IRI-133-75-09) Avail: NTIS HC A03/MF A01

A numerical method is presented for solving the partial differential equation that describes the diffusive movement of two oppositely charged ions in each other's Coulomb field both with respect to time and space. Results are presented on the evolution of the separation distribution in time, and the effect of different parameters is illustrated. The mobility for the ions not to have recombined as a function of time is calculated and is considered in some detail. This method is employed to calculate the yield of charged species as a function of time after formation in some irradiated hydrocarbon liquids. The value of the initial yield of pairs of charged species, and the form of the initial distributions of separations are discussed. Author (ESA)

N77-25928# Army Electronics Command, Fort Monmouth, N. J.
APPLICATION OF BETHE'S THEORY ON ELECTRON SCATTERING TO E-BEAM LITHOGRAPHY
Gerald J. Iafrate, John N. Helbert, Arthur D. Ballato, and Walter S. McAfee Feb. 1977 14 p refs
(AD-A036124; ECOM-4466) Avail: NTIS HC A02/MF A01 CSCL 20/7

In this report, attention is focused on the question of the spatial extent developed by an intermediate energy (5-20 keV) scattered electron beam in a lithographic E-beam resist material. Use is made of the multiple scattering theory of Bethe to calculate the average cosine between the actual direction of motion, and the direction of the primary electron beam in terms of the average nuclear charge of the target and the depth of electron penetration into the target. Use is made of the average cosine calculation to establish an order-of-magnitude expression for the depth at which two electron-beam lines overlap to cause undercutting. Author (GRA)

N77-25929# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
ATS-6 NOAA SOLID STATE PROTON EXPERIMENT: MEAN ENERGY OF A FINITE ENERGY PASSBAND
J. A. McKinnon and T. A Fritz Dec. 1976 53 p refs
(PB-264786/5; NOAA-TM-ERL-SEL-45; NOAA-77021402) Avail: NTIS HC A04/MF A01 CSCL 18D

Using the difference of two Gaussian integrals to generate the measured detector efficiency profile and an experimentally verified form of the proton differential energy spectrum, predicted counting rates for selected channels of the ATS-6 NOAA Low Energy Proton Experiment were computed, tabulated and graphed for a wide range of anticipated proton spectra slopes. Tables and graphs presented as a function of particle spectrum slope for each passband include not only the theoretical detector response but counting rate ratios of adjacent energy windows and the spectrum slope weighted mean energies. GRA

N77-25930# Systems Science and Software, La Jolla, Calif.
E-BEAM BENCHMARK CALCULATORS. PROBLEM NO. 1
James Harvey, Ira Katz, and Andrew Wilson Apr. 1976 76 p refs
(Contract DNA0001-76-C-0121)
(AD-A035607; SSS-R-76-2898; DNA-3974T) Avail: NTIS HC A05/MF A01 CSCL 18/6

The transport of a large area electron beam in a cylindrical tank is analyzed using the 2- D FRED/EM and GFRED particle codes. Calculations were performed under both vacuum and non-zero density conditions using prescribed injected electron energies and current pulses. The results illustrate, dynamically, the effects of space-charge limiting and neutralization by the gas background. At the highest pressures examined, a collective instability develops. Author (GRA)

N77-25931# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
EFFECT OF CAVITY LOADING ON ANALYTICAL ELECTRON SPIN RESONANCE SPECTROMETRY Technical Report, 1 Oct. 1976 - 31 Jan. 1977
Ira B. Goldberg and Harry R. Crowe Feb. 1977 27 p refs
(Contract N00014-73-C-0325)
(AD-A035726; SC549.22TR; TR-8) Avail: NTIS HC A03/MF A01 CSCL 07/4

The effect of cavity loading during magnetic resonance absorption of the accuracy of analysis by electron spin resonance techniques is calculated. Large samples, which degrade the cavity Q-factor due to absorption of a large fraction of the incident radiation cause a non-linearity of the absorption as a function of concentration. This is reflected by a broadening of the first derivative spectrum and reductions of the peak-to-peak amplitude and the double integral of the derivative from that predicted on the basis of diluted sample. Calculations of this effect are verified with samples of MnSO4 H2O. Nonlinearities in the order of 1% may be obtained with samples of 0.4 to 1.0 mg of MnSO4 H2O. or 0.1 to 0.25 mg of diphenlypicrylhydrazyl DPPH which are commonly used standards. Author (GRA)

N77-25932# Harry Diamond Labs., Adelphi, Md.
AN EVALUATION OF THE 225W ELECTRON BEAM MACHINE
Gary L. Skillington, Timothy R. Oldham, and Dale R. Schallhorn Dec. 1976 15 p refs
(DNA Proj. NWED-QAXAA121; HDL Proj. 227623)
(AD-A035857) Avail: NTIS HC A02/MF A01 CSCL 14/2

Diagnostic experiments have been conducted by the Harry Diamond Laboratories to determine the beam characteristics of the Physics International PI225W Electron Beam Machine. The purpose of these experiments was to provide reproducibility, uniformity, and depth-dose information for material experiments being conducted by personnel from Los Alamos Scientific Laboratory. The 225W uses magnetic-beam transport hence many stable fluence levels and beam sizes were available. However, only the 45 cal/sq cm, 6.5-sq cm area level was studied. At this level, the shot-to-shot reproducibility had a standard deviation which was 10 to 12 percent of the mean. It was found that the beam had an annular pattern, sometimes varying as much as 60 percent from the mean fluence. The diode diagnostics, as well as a PI Faraday cup, were used to generate an electron energy spectrum having an average electron energy of 247 KEV. This spectrum was used, in turn, to predict the depth-dose profile in carbon. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N77-25933*# Illinois Univ., Urbana. Graduate Coll.
ELECTRON ENERGY DISTRIBUTIONS IN URANIUM HELIUM MIXTURES M.S. Thesis
Michael Anthony Makowski 1977 35 p refs
(Grant NsG-1063)
(NASA-CR-153216) Avail: NTIS HC A03/MF A01 CSCL 18H

The high energy portion of the electron energy distribution for mixtures of uranium and helium at 1 atm, 5000 K, and a neutron flux of 2x10 to the 12th power/sq cm-sec have been calculated. The addition of He improves the heat transport characteristics of the plasma and has the feature that the He energy levels lie in the high energy portion of the electron distribution, potentially allowing non maxwellian excitation. It is concluded, however, that the resulting reaction rates are marginal relative to achieving inversion in He. Author

N77-25934# Oak Ridge National Lab., Tenn.
ESTIMATE OF THERMOELASTIC HEAT PRODUCTION FROM SUPERCONDUCTING COMPOSITES IN PULSED POLOIDAL COIL SYSTEMS
J. K. Ballou and W. H. Gray Nov. 1976 15 p refs Presented at 2nd ANS Topical Meeting on the Technol. of Controlled Nucl. Fusion, Richland, Wash., 21 Sep. 1976
(Contract W-7405-eng-26)
(ORNL-TM-5661; Conf-760935) Avail: NTIS HC A02/MF A01

In the design of the cryogenic system and superconducting

magnets for the poloidal field system in a Tokamak, it is important to have an accurate estimate of the heat produced in superconducting magnets as a result of rapidly changing magnetic fields. A computer code, PLASS (pulsed losses in axisymmetric superconducting solenoids), was written to estimate the contributions to the heat production from superconductor hysteresis losses, superconductor coupling losses, stabilizing material eddy current losses and structural material eddy current losses. Recently, it was shown that thermoelastic dissipation in superconducting composites can contribute as much to heat production as the other loss mechanisms mentioned above. A modification of PLASS is discussed which takes into consideration thermoelastic dissipation in superconducting composites. A comparison between superconductor thermoelastic dissipation and the other superconductor loss mechanisms is presented. ERA

N77-25935# Montpellier Univ. (France). Dept. de Physique Mathematique.
CLUSTERING PHENOMENA AND PROTON ANTIPROTON ANNIHILATION AT REST
E. Pelaquier Sep. 1976 18 p refs
(PM/76/7) Avail: NTIS HC A02/MF A01

Several arguments dealing with the theoretical characteristic as well as the phenomenological implications of cluster models show that the nucleon-antinucleon system has the main properties of a cluster. The simple and double distributions of the pions produced in the proton antiproton annihilation at rest are well described in terms of a quasi two-body cascade. The two particle correlations were studied in this reaction, and introducing them as a fine structure in a cluster model is suggested. The proton antiproton cluster can be used to describe many high energy reactions such as the decay of phi and the D antiD system in the electron positron annihilation. ESA

N77-25936# Montpellier Univ. (France). Dept. de Physique Mathematique.
SINGLE NEGATIVE W POSITIVE W PRODUCTION BY POSITRON ELECTRON YIELDS W PLUS HADRONS
F. M. Renard and M. Talon Jan. 1977 9 p refs
(PM/77/3) Avail: NTIS HC A02/MF A01

It is shown that the annihilation reaction electron positron yields positive and negative omega mesons can be an interesting source of single negative and positive omega-mesons production for a total center of mass energy of greater than or equal to 65 GeV at a rate of 10 to the minus 36th power to 10 to the minus 35th power sq cm. ESA

N77-25937# Montpellier Univ. (France). Dept. de Physique Mathematique.
CONNECTION BETWEEN FIXED ANGLE AND FIXED MOMENTUM TRANSFER SCATTERING IN THE FRAMEWORK OF THE DOUBLE PHASE REPRESENTATION
G. Grunberg Nov. 1976 42 p refs
(PM/76/10) Avail: NTIS HC A03/MF A01

The double phase representation of Sugawara and Nambu, which assumes some simple analytical properties with respect to momentum transfer for the phase of the amplitude, was applied to the discussion of large angle scattering. From the assumptions of Regge behavior and finite asymptotic Regge trajectories, the fixed angle scaling laws and the extrapolation to the large angle region of the Regge formula are derived; the high momentum transfer behavior of Regge residues is thereby obtained. As a byproduct, the general form of the amplitude (including its phase) is obtained in the large angle region. A correlation between the forward-backward asymmetry of the angular distribution in a given channel and the ratio of the 90 deg cross sections in the other two channels is shown to be present in a simple case. Applications are given to various scattering processes. Author (ESA)

N77-25938# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
ALPHA PARTICLE PROBLEMS IN SHIELDED SUPPORT SYSTEMS
B. Lehnert Dec. 1976 23 p refs
(TRITA-EPP-77-01) Avail: NTIS HC A02/MF A01

Alpha particle confinement was considered in the case of internal conductor systems with magnetically shielded supports. The treatment includes problems of energy transfer to the background plasma, the balance between radiation losses and alpha particle heating, mirror confinement in the main poloidal field, the cut-off and shielding conditions at the supports, ambipolar electric fields, wall interaction, and support location. With a proper and technically realizable choice of parameter values, it should become possible to achieve alpha particle heating as well as to manage the reactor technological problems due to alpha particle interaction with the supports. Author (ESA)

N77-25939# Naval Research Lab., Washington, D. C.
MAGNETIC COMPRESSION OF CHARGE-NEUTRALIZED ION BEAMS Final Report
David Mosher Nov. 1976 35 p refs
(AD-A033859; NRL-MR-3413) Avail: NTIS HC A03/MF A01 CSCL 20/3

Magnetic compression of a cold, charge-neutralized ion beam due to passage through a slowly-varying magnetic-mirror field is studied. Conditions on the field and beam parameters are derived which permit the beam to be compressed to order-of-magnitude higher current densities while preserving the laminar nature of the flow. Effects associated with rotation, beam convergence, and velocity shear in the incident beam, and those due to self fields are included in the analysis. Utilization of compressed beams extracted from reflex triodes and ion diodes for heating of thermonuclear plasmas is discussed. Author (GRA)

N77-25940# Naval Postgraduate School, Monterey, Calif.
A COMPARISON OF INTEGRATION METHODS FOR THE SOLUTION OF NONLINEAR REACTOR DYNAMICS PROBLEMS THROUGH THE USE OF FINITE ELEMENTS M.S. Thesis
Ralph Carroll Sheldrick Dec. 1976 145 p refs
(AD-A035862) Avail: NTIS HC A07/MF A01 CSCL 18/11

A comparison of numerical methods utilized by the finite element technique for solving a nonlinear nuclear reactor dynamics problem was conducted. Using the Crank-Nicolson, DVOGER Gear, and Implicit Gear methods, the results showed the Implicit to be the superior method investigated. This is based on the fact that all three methods yielded the same steady state solutions, but the Implicit Gear method used significantly less CPU time and comparable storage to Crank-Nicolson. This was particularly apparent as the degrees of freedom were increased. In addition, the transient solution in all cases was better than that obtained in Crank-Nicolson and compared favorably to that of Gear's method. GRA

74 OPTICS

Includes light phenomena.

N77-25941*# Gustincic (J. J.) Consulting Engineer, Marina Del Rey, Calif.
A MILLIMETER WAVE QUASI-OPTICAL MIXER AND MULTIPLIER Final Report
1 Mar. 1977 33 p ref Prepared for JPL
(Contracts NAS7-100; JPL-954492)
(NASA-CR-153065; TR078) Avail: NTIS HC A03/MF A01 CSCL 20F

The results of an experimental study of a biconical quasi-optical Schottky barrier diode mount design which could be used for mixing and multiplying in the frequency range 200-1000 Ghz are reported. The biconical mount is described and characteristics measured at 185 Ghz are presented. The use of the mount for quasi-optical frequency doubling from 56 to 112 Ghz is described and efficiency estimates given. Author

N77-25942# California Univ., Livermore. Lawrence Livermore Lab. Dept. of Physics.
ADVANCED ELECTROOPTIC COMPONENTS FOR SATELLITE/SUBMARINE OPTICAL COMMUNICATIONS SYSTEMS Interim Report
John B. Marling, Frederick T. Aldridge, and Lowell L. Wood 30 Sep. 1976 10 p refs
(Contracts W-7405-eng-48; N00014-76-F-0023)
(UCID-17298) Avail: NTIS HC A02/MF A01

Significant progress was made on identification and acquisition of optical components for an ultrahigh brightness weakly tunable blue-green beam generator. Limited performance validation of key system design concepts was achieved, and significant progress was made in improved optical design for more efficient generation of ultrahigh brightness, tunable blue-green radiation. These results are detailed. ERA

N77-25943# Texas Technological Univ., Lubbock. Optical Sciences Lab.
OPTICAL INFORMATION PROCESSING EXPERIMENTS FOR UNDERGRADUATE ENGINEERS Final Report
Gary K. Froehlich, John F. Walkup, and Marion O. Hagler Jan. 1977 173 p refs
(Grant NSF SER-75-17673)
(PB-264356/7; TTU-OSL-77-1) Avail: NTIS HC A08/MF A01 CSCL 20F

A set of ten experiments designed to introduce undergraduate engineering students to the area of modern optical information processing is described. The projects include reflection or 'white light' holography, holographic optical elements, binary computer-generated holograms, spatial filtering, coherent nonlinear processing, image subtraction using speckle patterns, optical display of the radar ambiguity function, and digital image processing. Each experiment is self-contained, including subsections on all components of the experimental technique and the principles it demonstrates. GRA

N77-25944# National Bureau of Standards, Washington, D. C.
MEASUREMENT OF ENERGY IRRADIANCE FROM SINGLE PULSE SOURCES Final Report
A. R. Schaefer and E. F. Zalewski Feb. 1977 35 p refs
(PB-264136/3; NBS-TN-935) Avail: NTIS HC A03/MF A01 CSCL 20F

A method of measuring the energy irradiance from a single pulsed source, such as a xenon flashtube, is presented. Details of the approach used in this particular measurement are given, along with a discussion of the data analysis. In particular, some of the inherent problems encountered in curve fitting which are also common to other radiometric and photometric measurements are considered. GRA

N77-25945# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
AUTOMATED IMAGE ENHANCEMENT TECHNIQUES FOR SECOND GENERATION FLIR, PHASE 1 Interim Progress Report, 1 Jul. - 1 Dec. 1976
D. H. Tack and P. Narendra 20 Dec. 1976 72 p refs
(Contract DAAG53-76-C-0195)
(AD-A035627; HONEYWELL-76-SRC/57; IPR-1) Avail: NTIS HC A04/MF A01 CSCL 17/5

This report is the first interim progress report for Contract DAAG53-76-C-0195, Automated Image Enhancement Techniques for 2nd Generation FLIR. It describes results of Phase I studies of image processing applications to FLIR imaging systems from July 1, 1976 to December 1, 1976. Author (GRA)

N77-25946# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
A DISCUSSION OF HARDWARE IMPLEMENTATION FOR AN AUTOMATIC TARGET CUEING SYSTEM Quarterly Report
31 Oct. 1976 43 p Prepared for Maryland Univ., College Park
(Contract DAAG53-76-C-0138)
(AD-A035037; QR-2) Avail: NTIS HC A03/MF A01 CSCL 17/5

This is the second quarterly status report on a program for RECOGNITION TECHNOLOGY FOR A SMART SENSOR, being conducted by the Westinghouse Systems Development Division for the Computer Science Center, University of Maryland. The program consists of three phases, as follows: Phase 1-Task and Technology Review (3 months); Phase 2-Algorithm Selection and Test (9 months); Phase 3-Hardware Development (9 months). This report covers the first 3 months of the Phase 2 effort. Westinghouse is concentrating on the hardware implementation of the Maryland algorithms for the focal plane and treating them as a system. Clearly, it is desirable to incorporate an auto cueing system into as small and cheap a box as possible. Implementation on the focal plane in compatible structures is desirable for these reasons and is the thrust of Second Generation FLIR work. GRA

N77-25947# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
ATMOSPHERIC TRANSMISSION MODELING: PROPOSED AEROSOL METHODOLOGY WITH APPLICATION TO THE GRAFENWOEHR ATMOSPHERIC OPTICS DATA BASE Final Report
Robert E. Roberts Dec. 1976 32 p refs
(Contract DAHC15-73-C-0200)
(AD-A035765; P-1225; IDA/HQ-76-18603) Avail: NTIS HC A03/MF A01 CSCL 20/6

Using Mie calculations for a wide variety of measured and assumed particle size distributions, a strong relationship between the total volume content of the particulate along the transmission path and the aerosol extinction coefficient was established. Field measurements, such as those taken at Grafenwoehr, Federal Republic of Germany, further established the validity of the relationship. Both theory and experiment suggest that a phenomenological scaling of photopic transmission related to normal meteorological visibility to the infrared IR windows is possible which furthermore is independent of the structure or shape of the particle size distribution. A second important implication is that a simple, possibly remote measurement of a quantity related to the volume or mass of the aerosol could provide a direct measure of the IR transmission, an IR visibility meter. Such a routine meteorological measurement would clearly be of use to sensor performance modeling. Author (GRA)

N77-25948# Hughes Research Labs., Malibu, Calif.
MULTIDITHER ADAPTIVE ALGORITHMS Interim Technical Report, 1 Nov. 1975 - 30 Jun. 1976
James E. Pearson, K. M. Brown, M. L. Minden, K. D. Price, and C. Yeh Nov. 1976 64 p refs
(Contract F30602-76-C-0022; ARPA Order 1279)
(AD-A035150; RADC-TR-76-364) Avail: NTIS HC A04/MF A01 CSCL 17/8

The use of Zernike-polynomial modal-control coherent optical adaptive techniques (COAT) in a multidither adaptive optical system has been studied analytically. The studies have defined those modes which will be implemented into an experimental COAT system for studying thermal blooming compensation. No apparent advantage in degree of phase correction has been established for modal versus zonal multidither control. A 37-element, all-beryllium, deformable mirror has been constructed. Preliminary tests show a surface deformation sensitivity of 0.28 micrometers/150 V and a usable frequency response to 30 KHz. Corrected irradiance-tailoring results reaffirm an earlier conclusion that thermal blooming is best minimized by making the transmitter aperture as large as possible and the irradiance distribution as uniform as possible. GRA

N77-25949# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
REDUCTION OF SOLAR GLINTS FROM THE SEA WITH A LINEAR POLARIZER
J. J. Beard Oct. 1976 31 p refs
(Contract N00123-76-C-0708; ZF3234401)
(AD-A036152; ERIM-120500-9-T) Avail: NTIS HC A03/MF A01 CSCL 15/4

Shipboard defense systems employing infrared warning receivers have experienced saturation of threat detection processing circuits due to the signal resulting from solar reflection from the rough sea surface. The saturation has made it necessary to blank the threat sector below the horizon for an azimuth extent of up to + or - 23 deg either side of the azimuth of the sun. The analysis shows that the use of linear polarizer with a shipboard IR warning receiver can be expected to increase number of daylight hours that the sensor can be operated without any blanking, and to narrow the azimuth sector for which blanking is required for low sun angles. The linear polarizer will be most effective during the middle of the day during the spring, summer, and fall. The unpolarized receiver typically may have to be blanked over a + or - 23 deg segment of its azimuth search below the horizon nine to eleven hours per day. With a linear polarizer the number of hours for which blanking will be necessary can typically

be reduced to six to eight hours per day and the aximuthal extent of the blaking during the remaining hours reduced to + or - 12 deg. Further consideration is needed of Navy operational practices and the types and frequencies of occurrence of various sea states encountered at various latitudes, a wave slope model valid for high slopes and wind speeds, and a simulation in which the ship defense system noise, threshold, and spatial resolution are parameters. Author (GRA)

N77-25950# Army Metrology and Calibration Center, Redstone Arsenal, Ala. Metrology Development and Engineering Div.
DEVELOPMENT OF A HIGH ACCURACY LUMINANCE CALIBRATION SERVICE FOR RADIOLUMINOUS SOURCES Final Report
L. Fecteau 10 Feb. 1976 60 p
(AD-A035516; AMCC-MM-76-1) Avail: NTIS HC A04/MF A01 CSCL 20/6

A technique has been developed for accurately measuring the luminance of Quasi-monochromatic Radioluminous sources (RLS'S). This development is part of an overall effort to improve the specification subsequent procurement of low light level RLS'S. This technique involves the accurate measurement of spectral radiance of the RLS via a spectroradiometer which has been calibrated directly against a freezing point of gold primary standard blackbody. The spectral radiance is then combined with the appropriate luminosity weighting function E.E., the C.I.E. Chromaticity Diagram Photopic eye response, and the luminance is calculated. Measurements on four radioluminous sources calibrated previously by the National Bureau of Standards (NBS) produced agreement to + or - 1% for three sources and a disagreement of 3% on one source at the 50 microlambert level. Since our process repeatability is about + or - 2%, we have assigned an overall uncertainty of + or - 3.6% for measurements in the 25-1,500 microlambert range. The main restriction in our technique is that the sources to be calibrated must have a planar surface area of at least 21 and preferably 25 millimeters diameter which radiates uniformly. GRA

N77-25951# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
THE 1.06 MICRON PHOTODETECTOR DEVELOPMENT Final Report, 1 Aug. 1975 - 1 Feb. 1976
J. S. Harris, Jr., R. C. Eden, L. O. Bubulac, I. Deyhimy, and K. Nakano Oct. 1976 95 p refs
(Contract F33615-76-C-1001; AF Proj. 2001)
(AD-A035772; AFAL-TR-76-121) Avail: NTIS HC A05/MF A01 CSCL 17/5

The design and progress towards realizing very high sensitivity 1.06 micrometers photodetectors are reported. This research program consists of two projects: a high sensitivity 5 MHz optical receiver and a field-assisted double heterojunction photocathode. A 5 MHz, 1.06 micrometers Ga As Sb avalanche photodiode APD receiver was built, tested and its noise performance modeled to determine the ultimate performance achievable with this technology. The initial receiver was better than an equivalent Si APD receiver by a factor of 2, and this was with very low gain in the Ga As Sb APD. Considerable overall improvement is predicted with higher gain APD's. Cs activation to achieve negative electron affinity NEA on heterojunction devices has been the major emphasis in the photocathode project. A sputter cleaning and annealing process was developed which produced excellent activations on Ga As. The first results are reported on a double heterojunction device which has been activated to NEA and operated in vacuum. This device exhibited very large dark current under applied bias which is not yet understood. Further work in understanding this dark current will be required in order to realize the potential of the field-assisted photocathode. Author (GRA)

N77-25952# Communications Research Centre, Ottawa (Ontario).
THE CCS-280 OPTICAL-FIBER LINK TASK Final Report
Elmer H. Hara, H. Claire Frayn, and Akira Watanabe Dec. 1976 34 p refs Sponsored by the Canadian Dept. of National Defence
(AD-A035435; CRC-1296; DRB-TELS-40) Avail: NTIS HC A03/MF A01 CSCL 20/6

The development of an experimental optical-fiber link for the Command and Control System 280 (CCS-280) of the DDH-280 Destroyer Escorts of the Canadian Forces is described. The objective of the task was to demonstrate the application of optical-fiber transmission links in a land-based CCS-280, and thereby alert and inform the armed forces of the advantages of optical-communications technology in military systems. The Task was planned and managed by the Department of Communications on behalf of the Department of National Defense, while the design and implementation of the optical link were accomplished through industrial contracts. All test conditions set by the Directorate of Maritime Combat Systems were satisfied by the experimental optical-fiber link. Author (GRA)

N77-25953# Naval Electronics Lab. Center, San Diego, Calif.
FIBER OPTICS AND INTEGRATED OPTICS TECHNIQUES FOR SIGNAL PROCESSING Research and Development Report, Apr. - Sep. 1976
George M. Dillard, Barry R. Hunt, and Henry F. Taylor 1 Feb. 1977 70 p refs
(XF54583005)
(AD-A035867; NELC-TR-2013) Avail: NTIS HC A04/MF A01 CSCL 20/6

This report introduces some new device concepts based on the technologies of fiber optics and integrated optics, and discusses the potential uses of these devices in signal processing. Analog-to-digital converters, delay-line devices including transversal filters, pseudorandom sequence generators, rf spectrum analyzers, and switching networks are described and analyzed in some detail. Applications for these devices in the improvement of signal processing for radar, electronic warfare, communications, and multisensor data collection systems are investigated. It is concluded that the new optical technologies offer the potential for substantial reduction in size, weight, and power and improvement in performance and/or cost over present or alternative techniques for a variety of systems which process broadband greater than 100-MHz bandwidth signals. Author (GRA)

N77-25954# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
TEST PROCEDURE REVISION FOR RETRO-REFLECTIVE MEASUREMENTS Final Report, Sep. 1972 - Apr. 1976
Edwin Heck, A. Aug. 1976 58 p
(AD-A034988; MERADCOM-2187) Avail: NTIS HC A04/MF A01 CSCL 20/6

A test method for measuring the retroreflectance property of samples in a laboratory room, using mirrors to fold the beam, is studied. Author (GRA)

N77-25955# Maryland Univ., College Park. Computer Science Center.
ALGORITHMS AND HARDWARE TECHNOLOGY FOR IMAGE RECOGNITION Quarterly Report, 1 May - 31 Jul. 1976
Tom Willett 30 Jul. 1976 72 p refs Prepared by Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
(Contracts DAAG53-76-C-0138; ARPA Order 3206)
(AD-A035027; QR-1) Avail: NTIS HC A04/MF A01 CSCL 17/5

Contents: Definition of the automatic target cueing function; System design goals; Hardware constraints; Hardware implementation; Treshold algorithm; Parallel processing; Noise region filtering; Alternative hardware directions; and Applicable CCD techniques and fabrication. GRA

N77-25956# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.
SHORT-TERM AVERAGE IRRADIANCE PROFILE OF AN OPTICAL BEAM IN A TURBULENT MEDIUM
M. T. Travis and H. T. Yura 28 Jan. 1977 46 p refs
(Contract F04701-76-C-0077)
(AD-A035817; TR-0077(2608)-1; SAMSO-TR-77-27) Avail: NTIS HC A03/MF A01 CSCL 20/6

The short-term average irradiance profile of a focused laser beam transmitted through a homogeneous-isotropic medium has been determined by using the extended Huyens-Fresnel principle and by modifying the phase structure function to remove tilt. Central to the analysis is the short-term average mutual coherence

function (MCF) of a spherical wave which has been determined from the modified phase structure function. Assuming a Kolmogorov spectrum, the modified phase structure function has been determined for three specific aperture functions. These same functions are then used to determine the short-term irradiance profiles. Numerical calculations have been performed, and the results are presented for uniform and Gaussian aperture functions for various values of aperture obscuration and for various strengths of turbulence values. GRA

N77-25957# Air Force Academy, Colo. Frank J. Seiler Research Lab.
ESTIMATION AND CONTROL IN MULTIDITHER ADAPTIVE OPTICS
Robert B. Asher and Robert F. Ogrodnik Dec. 1976 35 p refs
(AF Proj. 2304)
(AD-A034396; FJSRL-TR-76-0015) Avail: NTIS HC A02/MF A01 CSCL 20/6

This paper develops optimal statistical estimation formulation for multidither adaptive optics control loops which potentially can enhance stable beam control performance in the presence of spurious signal like noise. A multidither autofocus example is chosen to compare estimated assisted and conventional adaptive optical performance in the presence of speckle generated noise. Author (GRA)

N77-25958# RAND Corp., Santa Monica, Calif.
ATMOSPHERIC VISUAL AND INFRARED TRANSMISSION DEDUCED FROM SURFACE WEATHER OBSERVATIONS: WEATHER AND WARPLANES, 6 Interim Report
R. E. Huschke Oct. 1976 48 p refs
(Contract F44620-73-C-0011)
(AD-A036032; R-2016-PR) Avail: NTIS HC A03/MF A01 CSCL 17/8

A quantitative method has been developed to evaluate meteorological data, surface weather observations, in terms of the performance of visual and infrared sensors so that relevant time and space variability in performance can be depicted. Approximate atmospheric transmission parameters for visible and infrared radiation are deduced from common weather observables (cloud data, temperature, humidity, etc.) as are vertical profiles of the parameters. Use of these algorithms with a set of target acquisition modeling equations can produce target detection probabilities and can be employed in battle simulation models to examine how force effectiveness varies as a function of weather and climate. Author (GRA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-25959 British Library Lending Div., Boston Spa (England).
THE CONTROLLED FORMATION OF A COMPACT TOROIDAL STRUCTURE WITH A PULSED BARRIER FIELD
A. G. Eskov, A. G. Kalygin, R. Kh. Kurtmullaev, M. I. Kutuzov, Ya. N. Laukhin, A. I. Malyutin, A. I. Markin, A. P. Proshletsov, and V. N. Semenov Sep. 1976 18 p refs Transl. into ENGLISH of the Russian paper IAEA-CN-35/E 17-2 Presented at the 6th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, W. Germany, 6-13 Oct. 1976
(BLL-CTO-1288-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

A thermonuclear system with a closed magnetic structure and pulsed plasma heating are described. Longitudinal shock compression of an elongated plasma toroid is considered as the principal method of heating. Two physical systems of providing facilities for the formation, heating and prolonged confinement of a plasma are examined. The first system is geometrically similar to the familiar belt pinch while the second system is a reversed field theta pinch in which a compact toroidal structure is produced by reconnecting opposing magnetic fluxes. Author

N77-25960 British Library Lending Div., Boston Spa (England).
THERMAL THERMONUCLEAR INSTABILITY IN A TOKAMAK-REACTOR
Ya. I. Kolesnichenko and S. N. Reznik Sep. 1976 21 p refs Transl. into ENGLISH of the Russian paper IAEA-CN-35/I 9-2 Presented at the 6th IAEA Conf. on Plasma Physics and Controlled Nuclear Fusion Res., Berchtesgaden, West Germany, 6-13 Oct. 1976
(BLL-CTO-1293-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Thermal thermonuclear instability (thermonuclear burning instability) in a Tokamak reactor is considered assuming that the duration of the plasma pulse is considerably longer than the plasma energy lifetime. The influence of the finiteness of the time taken for thermalization of the highly energetic alpha-particles (thermonuclear reaction products) and also the finiteness of the time taken for exchange of energy between the electron and ion components of the plasma, on the thermal instability is investigated. It is shown that when allowance is made for these factors, the steady-states with positive derivatives of da/dT are stable as before. The approximation to these states may however assume the form of damped temperature oscillations about T(st). The possibility of nonself-sustaining stable thermonuclear burning is also considered. It is shown that, unlike self-sustaining thermonuclear burning, when additional power is supplied to the plasma, it is possible for a stable steady-state (quasi-steady-state) thermonuclear reaction regime to be established at relatively low plasma temperatures. In this case, the energy liberated as a result of fusion reactions may considerably exceed the energy supplied to the plasma. Author

N77-25961 British Library Lending Div., Boston Spa (England).
NON-LINEAR HELICAL MHD INSTABILITY
N. I. Gerlakh, N. M. Zueva, and L. S. Solovev 11 Nov. 1976 32 p refs Transl. into ENGLISH of Russian report, Preprint no. 84, 1976
(BLL-CTO-1273-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

The development of MHD instability with time in a plasma cylinder is considered. It is shown that the development of instability is resonant in character. When maximum instability is achieved at the non-linear stage, the instability embraces the whole of the plasma cross-section and causes the magnetic surfaces to be turned inside out. In a toroidal geometry the instability considered is evidently stabilized by a magnetic well with certain limitations on the current distribution in the plasma. Author

N77-25962 British Library Lending Div., Boston Spa (England).
SOME PROBLEMS OF A TOKAMAK WITH FAST NEUTRAL INJECTION
V. I. Pistunovich 11 Nov. 1976 5 p Transl. into ENGLISH from Fiz. Plasmy (USSR), v. 2, no. 1, 1976 p 3-23
(BLL-CTO-1256-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

The introduction of additional methods of plasma heating may simplify the problem of building a Tokamak reactor. When the plasma temperature is increased to 10 to 20 keV, the power loss due to cyclotron radiation becomes substantially less than the power of the thermonuclear reactions in the D-T mixture. It is no longer necessary to increase the magnetic field above 100 kG, and the thermal loads on the wall may be reduced. Plasma heating by fast atom injection (ignition reactors) and by a flux of fast particles from an injector (injection reactors) is discussed. Basic physical problems which must be solved before a Tokamak injection reactor is built are explored. A.R.H.

N77-25963*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACTORS AFFECTING ION KINETIC TEMPERATURE, NUMBER DENSITY, AND CONTAINMENT TIME IN THE NASA LEWIS BUMPY-TORUS PLASMA
J. Reece Roth Washington May 1977 67 p refs
(NASA-TN-D-8466; E-9042) Avail: NTIS HC A04/MF A01 CSCL 20I

The degree of toroidal symmetry of the plasma, the number of midplane electrode rings, the configuration of electrode rings, and the location of the diagnostic instruments with respect to

the electrode rings used to generate the plasma are discussed. Impurities were deliberately introduced into the plasma, and the effects of the impurity fraction on ion kinetic temperature and electron number density were observed. It is concluded that, if necessary precautions are taken, the plasma communicates extremely well along the magnetic field lines and displays a high degree of symmetry from sector to sector for a wide range of electrode ring configurations and operating conditions. Finally, some characteristic data taken under nonoptimized conditions are presented, which include the highest electron number density and the longest particle containment time (1.9 msec) observed. Also, evidence from a paired comparison test is presented which shows that the electric field acting along the minor radius of the toroidal plasma improves the plasma density and the calculated containment time more than an order of magnitude if the electric field points inward, relative to the values observed when it points (and pushes ions) radially outward. Author

N77-25964# Princeton Univ., N. J. Plasma Physics Lab.
PENETRATION AND LINEAR ABSORPTION OF LOWER HYBRID WAVES IN A TOKAMAK PLASMA
S. Bernabei and I. Fidone (Euratom-CEA, Fontenay-Aux-Roses, France) Sep. 1976 24 p refs Presented at the 3rd Intern. Symp. on Plasma Heating in Toroidal Devices, Varenna, Italy, 6-17 Sep. 1976
(Contract E(11-1)-3073)
(PPPL-1277) Avail: NTIS HC A02/MF A01

Penetration and linear absorption of slow waves in a hot Tokamak plasma is studied for waveguide coupling. For this coupling system, the emphasis is placed on the role of the plasma density profile, facing the waveguides over the spectrum of the energy flux launched. This spectrum consists of three portions: a first portion is likely to be trapped in the outer part of the plasma and might be responsible for absolute parametric instability. A second portion penetrates deep into the plasma and may be absorbed by ions via ion-cyclotron or perpendicular Landau damping after being converted into short wavelength Bernstein-like modes. The remaining portion is generally absorbed by electrons via electron Landau damping before reaching the region of lower hybrid wave conversion. ERA

N77-25965# Princeton Univ., N. J. Plasma Physics Lab.
CHEMICAL ENGINEERING SIDE OF NUCLEAR FUSION POWER
E. F. Johnson Oct. 1976 79 p refs
(Contract E(11-1)-3073)
(PPPL-1303) Avail: NTIS HC A05/MF A01

It is widely recognized that chemical engineering has important roles to play in the development of national and world wide energy resources through optimal utilization of fossil fuel reserves. It is much less appreciated that there are crucial chemical engineering problems in the development of energy production from other sources. In particular the successful development of nuclear fusion power generating systems will require the solution of many problems that are uniquely suited to chemical engineers. A brief overview of the fusion development program presents an identification of the major technological problems remaining to be solved. ERA

N77-25966# Oak Ridge National Lab., Tenn.
BANANA DRIFT DIFFUSION IN A TOKAMAK MAGNETIC FIELD WITH RIPPLES
K. T. Tsang Nov. 1976 23 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5630) Avail: NTIS HC A02/MF A01

The drift motions of trapped particles in a Tokamak field with ripples lead to a new transport process in large Tokamaks in addition to the diffusion process due to particles trapped in the ripples. We study this problem by solving the bounce averaged drift kinetic equation with a model collision operator. It is shown that the banana drift diffusion is proportional to the collision frequency when the poloidal banana drift frequency is smaller than the effective collision frequency. This result is contrary to earlier predictions. In a reactor regime, this loss mechanism is shown to be unimportant. ERA

N77-25967# General Atomic Co., San Diego, Calif.
SUPERCONDUCTING MAGNETS FOR FUSION
J. R. Purcell 20 Sep. 1976 10 p refs Presented at 2d ANS Topical Meeting on the Technol. of Controlled Nucl. Fusion, Richland, Wash., 21 Sep. 1976
(Contract E(04-3)-167)
(GA-A-14110; Conf-760935-37) Avail: NTIS HC A02/MF A01

Fusion reactor concepts that utilize magnetic confinement are generally envisioned as requiring superconducting magnets. For example, mirror machines will require very high field steady state magnets. Toroidal devices will utilize large steady state coils that may have to tolerate pulsed fields. In addition, Tokamaks employ ohmic heating coils that must handle large amounts of pulsed energy. Theta pinch reactors require large inductive energy storage systems. Some of these applications are in the context of today's superconducting technology as well as key R and D needs of special interest for fusion magnet technology. ERA

N77-25968# General Atomic Co., San Diego, Calif.
HEAT TRANSFER PROBLEMS IN NONCIRCULAR TOKAMAK EXPERIMENTAL POWER AND DEMONSTRATION REACTORS
D. W. Kearney, D. W. Graumann, and G. R. Hopkins 3 Mar. 1976 31 p refs Presented at Natl. Heat Transfer Conf., St. Louis, 8 Aug. 1976
(Contract E(04-3)-0167)
(GA-A-13857; Conf-760816-9) Avail: NTIS HC A03/MF A01

Initial conceptual design studies on Tokamak fusion reactors employing a noncircular plasma cross section are performed and heat transfer problems identified. The impact of cooling problems on reactor design are discussed for experimental power and demonstration reactors, emphasizing design features unique to the noncircular concept. Particular attention is given to the blanket/first wall configuration, cooling of the field shaping coil system, and the flowing plasma boundary impurity control system. ERA

N77-25969# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron Physics.
ELECTRICAL PROBE MEASUREMENTS IN LOW AND HIGH PRESSURE DISCHARGES Ph.D. Thesis
Dag Andersson Nov. 1976 9 p refs Sponsored in part by AGA, ESAB, and Swed. Board for Tech. Develop.
(TRITA-EPP-76-16) Avail: NTIS HC A02/MF A01

The construction of an apparatus for automatic determination of electron velocity distributions is described, and measurements of electron energy distributions before and after a stationary plasma sheath in a low pressure mercury discharge are presented. The sheath appears at a constriction of the discharge tube. The measurements were made with a spheric probe, using the second-derivative method, and the results show that the energy distribution on the anode side of the sheath is a sum of a thermal population and an accelerated distribution. Some measurements on a TIG (Triangular Inert Gas) welding arc are also described. Emitting probes were used to determine the potential distribution in the arc. In addition, measurements of the current-voltage characteristic of the arc, the current density, and the pressure at the anode were made. Gas streaming velocities along the axis were calculated. Author (ESA)

N77-25970# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
MAGNETOHYDRODYNAMIC STABILITY OF A PLASMA CONFINED IN A CONVEX POLOIDAL MAGNETIC FIELD
T. Hellsten Nov. 1976 32 p refs Sponsored by Euratom
(TRITA-EPP-76-18) Avail: NTIS HC A03/MF A01

A plasma confined in a purely poloidal magnetic field with a finite pressure at the boundary and surrounded by a conducting wall can be stabilized against magnetohydrodynamic perturbations even in the absence of shear and minimum-average-B properties. To achieve large pressure gradients the average magnetic field has to decrease rapidly outwards. The theory is applied to a Spherator configuration with a purely poloidal magnetic field. Author (ESA)

N77-25971# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
THE EXTRAP CONCEPT

B. Lehnert Nov. 1976 30 p refs
(TRITA-EPP-76-19) Avail: NTIS HC A03/MF A01

A recently suggested axially symmetric, quasi-steady, closed, high-beta confinement system is reviewed. A toroidal pinch of noncircular cross section is supposed to be immersed in the strong, inhomogeneous poloidal vacuum field from a set of ring-shaped conductors, all carrying currents in the opposite direction of the plasma current. Preliminary experiments are reported. Author (ESA)

N77-25972# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

FORCED RADIAL OSCILLATIONS OF A FULLY IONIZED CYLINDRICAL PLASMA SURROUNDED BY A PARTIALLY IONIZED PLASMA SHELL

M. Bures and E. Tennfors Dec. 1976 31 p refs Sponsored in part by Swed. Atomic Res. Council, Natl. Swed. Energy Source Develop., and European Communities
(TRITA-EPP-76-20) Avail: NTIS HC A03/MF A01

Forced radial magnetoacoustic oscillations of a fully ionized cylindrical plasma surrounded by a partially ionized plasma shell are excited by means of an external source. The radial profiles of the macroscopic field quantities in the fully and partially ionized regions are obtained as functions of the degree of ionization, the temperature, and the position of the boundary between the two regions. The absorbed power is calculated. The nonresonant as well as the resonant cases are treated. It is shown that the main part of the power is absorbed in the outer shell unless a suitable resonance is used to enhance the macroscopic field quantities in the fully ionized plasma part and the dimensions of the outer shell are kept small. Author (ESA)

N77-25973# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

FUSION RESEARCH AT THE ROYAL INSTITUTE OF TECHNOLOGY IN STOCKHOLM, 1977

B. Lehnert Dec. 1976 34 p refs
(TRITA-EPP-76-23) Avail: NTIS HC A03/MF A01

Research activities in plasma physics and controlled fusion during 1976 are reviewed together with plans for research in 1977, including short descriptions and motivations of the lines of approach being conducted by the laboratory. These lines include plasma-neutral gas interaction and stability, with special approaches to plasma stabilization, magnetic confinement being produced mainly by poloidal fields, as well as heating and diagnostics of impermeable plasmas. Author (ESA)

N77-25974# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).

HEATING OF A PINCH AT INTERMEDIATE GB-VALUES

J. A. Hoekzema, C. Bobeldijk, P. C. T. VanderLaan, and W. Schuurman Oct. 1976 21 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-76-98) Avail: NTIS HC A02/MF A01

The implosion heating of a plasma with a built-in magnetic field is discussed. The internal magnetic field is used to reduce the beta value of the plasma, for instance in screw-pinch experiments. The broadening of the imploding current sheath in a pinch is considerable, even in the absence of turbulence. This is especially true if beta is reduced by the presence of a bias field in the plasma. A revised snow-plow model, which takes into account the sheath broadening due to a trapped bias field, was used to calculate the electric field strength at the first wall, and the final temperature of a pinch. The complicated structure of the broadened sheath was approximated by a more simple structure. Calculations indicate that the results do not depend strongly on the detailed structure of the sheath and therefore the simplification is justifiable. Author (ESA)

N77-25975# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).

ON THE MACROSCOPIC OSCILLATION AND DEFORMATION OF THE PLASMA IN SPICA

M. Mimura (Nagoya Univ., Japan), W. Kooijman, and A. A. M. Oomens Oct. 1976 16 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-76-99) Avail: NTIS HC A02/MF A01

The stability behavior of the screw-pinch plasma in SPICA was studied by using a set of pick-up coils positioned around the minor circumference of the discharge tube. The data processing system, AD-converters combined with a computer, permits treating a large number of signals. The signals from the pick-up coils are transferred to the computer and are expanded into a Fourier series. The m = 1 cosine oscillation in the rise phase suggests a screw-pinchhmodel in which a plasma core is surrounded by a current layer and a vacuum region. An m = 2 deformation was found to correlate with the decay rate of the plasma current. Author (ESA)

N77-25976# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France). Dept. Physique et Chimie de l'Environnement.

NONEQUILIBRIUM PLASMA DIAGNOSTICS USING RANDOM MICROFIELD MEASUREMENTS [DIAGNOSTIC DE PLASMAS HORS D'EQUILIBRE AU MOYEN DE MESURES DU MICROCHAMP ALEATOIRE]

I. L. Freeston, R. Pottelette, and L. R. O. Storey Nov. 1975 34 p refs In FRENCH
(CRPE-NT-13) Avail: NTIS HC A03/MF A01

An experimental setup was constructed consisting of two dipole antennas for measurements of electrons with energies between 0.5 and 5 eV in electron plasmas. These electrons appear as photoelectrons in the heat flux balance of ionospheric and magnetospheric plasmas. A laboratory plasma without a magnetic field was studied. The measurement principle is based on the interaction between suprathermal electrons and longitudinal electrostatic waves (Landau waves) which propagate in the plasma at the same speed. The sensor part of the experimental device consists of two small electrical dipole antennas of the double sphere dipole type, immersed in the plasma and separated by a distance of one or several hundred Debye wavelengths. An antenna active and passive mode were used for measurements. ESA

N77-25977# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

PLASMA NEUTRAL GAS INTERACTION EFFECTS ON THE STABILITY OF DRIFT MODES

D. Ohlsson Nov. 1976 38 p refs
(TRITA-EPP-76-17) Avail: NTIS HC A03/MF A01

In quasi-steady fusion reactors partially ionized boundary layers are likely to be formed. The plasma density is then expected to be peaked close to the boundary. The possibility of large density gradients driving unstable drift modes in these layers was investigated. The expected magnetic shear, due to induced plasma currents in such systems, as well as minimum-average-B properties of the magnetic field, are probably insufficient to significantly influence the stability properties of these modes; however, effects associated with plasma-neutral gas interactions as well as with a finite Larmor radius and ion viscosity modify the behavior of drift modes and introduce stabilizing effects. Author (ESA)

N77-25978# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

VELOCITY OF PARTICLES RELEASED BY PLASMA STREAM EROSION OF SURFACES. SPECTROSCOPIAL DOPPLER MEASUREMENTS

Lars Kristoferson Dec. 1976 22 p refs
(TRITA-EPP-76-21) Avail: NTIS HC A02/MF A01

Velocity measurements of particles released from solid target surfaces exposed to a 300 eV proton plasma stream show a variety of particles with widely differing velocities. A spectroscopic Doppler technique was used in which two spectra of the same region, but taken from opposite directions, were imaged together on the film. This technique eliminates most of the calibration difficulties with the normal method using reference spectra and also gives more accurate results. Particles originating from the target bulk material were observed to be released with low energies, a few eV corresponding to less than 1,000 m/sec, as expected for physical and chemical sputtering. Some impurity particles (i.e. oxygen and carbon atoms), probably adsorbed to the surface, were, however, observed to be released with very high energies, sometimes several 100 eV corresponding to several times 10,000 m/sec, roughly equal to the plasma proton energies. Author (ESA)

N77-25979# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INTRODUCTION TO HYDRODYNAMICS OF REACTIVE PLASMAS
Gerard Fournier Dec. 1976 27 p refs In FRENCH; ENGLISH summary Presented at the Summer School 'Reactions Atomiques et Mol. dans les Plasmas', Les Houches, France, 17-30 Aug. 1976 Report will also be announced as translation (ESA-TT-386)
(ONERA-NT-1976-17) Avail: NTIS HC A03/MF A01

The hydrodynamics of reactive plasmas is a synthesis of several physics disciplines which are outlined successively. Problems of plasma physics are considered first. They are related to the evolution of charged particle density along the flow and to the determination of the electron distribution function and macroscopic properties depending on inelastic processes. Molecule excitation is discussed; vibration excitation is emphasized since it permits one to derive simple models, it being the most coupled with the flow generally and of interest for many types of lasers. The section on chemical reactions in a flow requires some background in chemical kinetics and thermodynamics. The subjects are chosen in order to give access to a general solution with a minimum of concepts and equations. The synthesis of the previous subjects for the flow study is limited to simple aerodynamic assumptions (especially one-dimensional flow). The interaction with radiation is outlined but the problems of stability and wall-flow interaction are not considered. Author (ESA)

N77-25980# Naval Research Lab., Washington, D. C.
FAST-ION TRANSPORT IN LASER-PRODUCED PLASMAS
D. G. Colombant and N. K. Winsor Nov. 1976 19 p refs
(NRL Proj. H02-29B)
(AD-A033271; NRL-MR-3393) Avail: NTIS HC A02/MF A01 CSCL 20/9

A simple but self-consistent model is presented to explain the emission of fast ions from laser-produced plasmas. The fast ions originate from the tail of the locally Maxwellian ion distribution. The internal fast ion source is thus determined by the macroscopic plasma parameters, while the signal which would be measured by an external fast-ion detector is the solution of a transport equation. This model explains what experimental parameters may most directly be related to the measured fast-ion signal. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N77-25981*# Kanner (Leo) Associates, Redwood City, Calif.
INFORMATION ON THE ELECTRONIC STRUCTURE OF METALS AND ALLOYS FROM THE HYPERFINE STRUCTURE OF MOSSBAUER SPECTRA
T. Zemcik Washington NASA May 1977 22 p refs Transl. into ENGLISH from Cesk. Cas. Fys. (Czech.), sekce A, v. 25, no. 5, 1975 p 464-475
(Contract NASw-2790)
(NASA-TT-F-17310) Avail: NTIS HC A02/MF A01 CSCL 20L

Electronic and magnetic structure of solids was studied by means of the hyperfine structure of Mossbauer spectra. The principle and realization of the Mossbauer effect confined to the Fe-57 isotopes and the problems involved in the study of hyperfine interactions of the nucleus with the electron shell are discussed. These include the isomeric shift, quadrupole splitting, and the magnetic splitting of nuclear levels. The connection between these quantities and concepts about the electronic structure of solids and the possibilities of interpreting experimental results in the field of metals and alloys (especially in the case of their magnetic ordering) are analyzed and demonstrated on selected examples of ferromagnetic solutions on an iron base. The Mossbauer spectrosocopy method is compared with other methods and its potential possibilities are discussed. Author

N77-25982*# Santa Barbara Research Center, Goleta, Calif.
FURTHER DEVELOPMENT OF AN INDIUM ANTIMONIDE (InSb)CHARGE-COUPLED INFRARED IMAGING DEVICE (CCIRID), 20-ELEMENT LINEAR IMAGER Final Report
15 Apr. 1977 41 p refs
(Contract NAS1-14395)
(NASA-CR-145204) Avail: NTIS HC A03/MF A01 CSCL 20L

Problems encountered in the development of an indium antimonide charge coupled device for infrared imaging and real time signal processing on the focal plane are summarized. A new generation chip is described which contains, 2, 4, and 20-element imagers, a 4-element TDI array, a monolithic gated charge integrator, and test devices. A system study of a future LANDSAT sensor system configured around an InSb TDi array is considered. A.R.H.

N77-25983# McElroy (Ralph) Co., Austin, Tex.
ELECTROSTATIC SURFACE POTENTIALS OF SELECTED CALCITE PLANES AND THEIR POSSIBLE RELATIONSHIPS TO THE MORPHOLOGY OF THIS MINERAL Ph.D. Thesis
O. Hering 1977 21 p refs Transl. into ENGLISH from Z. Kristallogr. (West Ger.), v. 110, 1958 p 145-164 Sponsored by ERDA
(INEL-TR-8) Avail: NTIS HC A02/MF A01

Surface potentials of ionic crystals are calculated. As an example, calcite is used because of the great variety in its form development. The surface potentials of 26 selected calcite planes are calculated according to the method of Madelung. The resulting order of magnitude of the potential is compared with the frequency of the occurrence of these faces on natural calcites. Author (ERA)

N77-25984# Interuniversitair Reactor Instituut, Delft (Netherlands).
NEUTRON DEPOLARIZATION MEASUREMENTS OF HoCo2 NEAR THE MAGNETIC PHASE TRANSITION
W. H. Kraan Sep. 1976 23 p refs
(IRI-132-76-04) Avail: NTIS HC A02/MF A01

Neutron depolarization measurements in the temperature range 65 to 90 K were performed at zero applied field using two neutron depolarization apparatus with neutron wavelengths of 1.5 A and greater than or equal to 4.0 A to investigate the magnetic phase transition of the intermetallic compound HoCo2. Experimental results have shown that the phase transition in HoCo2 is of the first order; the hysterisis observed confirmed this. In addition, the fact that neutron depolarization can be performed at zero field is another argument for this conclusion. ESA

N77-25985# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
EVALUATION OF PROCEDURES IN AUTOMATED RESIDUAL STRESS MEASUREMENTS
M. R. James and J. B. Cohen 10 Feb. 1977 83 p refs
(Contract N00014-75-C-0580)
(AD-A036127; TR-14) Avail: NTIS HC A05/MF A01 CSCL 20/2

The measurement of residual stress by the X-ray diffraction technique involves determining the lattice spacing of a crystallographic plane at different inclinations of the sample and relating the change in the spacing to a stress on the surface of the specimen. The sources of error in determining the residual stress are investigated in this report. A short review of the fundamental principles of the measurement is given. The important instrumental and geometric factors contributing to errors in the measured stress are presented. To account for random errors in the data accumulation on the measured stress, a complete statistical analysis based on a least-squares parabola is given. GRA

N77-25986# Colorado Univ., Boulder. Dept. of Electrical Engineering.
THEORY OF HETEROJUNCTION DISCONTINUITIES Final Technical Report, 1 Feb. 1974 - 30 Sep. 1976
Herbert Kroemer Dec. 1976 5 p
(Grant DAHC04-74-G-0114)
(AD-A034784; ARO-12061.5-A) Avail: NTIS

HC A02/MF A01 CSCL 20/12

The problem of theoretically understanding and predicting the energy band lineups at abrupt semiconductor heterojunctions was investigated. Methods were developed that represent a significant advance in the problem and that permit a prediction of the band edge discontinuities from the known energy band structures, by means of self-consistent pseudopotential calculations.

Author (GRA)

N77-25987# Harry Diamond Labs., Adelphi, Md.

RARE EARTH ION-HOST LATTICE 11. LANTHANIDES IN Y2AI5O12

Donald E. Wortman, Clyde A. Morrison, and Nick Karayianis Aug. 1976 136 p refs

(DA Proj. 1T1-61102-AH-46)

(AD-A033884; HDL-TR-1773) Avail: NTIS HC A07/MF A01 CSCL 07/4

Previously reported spectra of triply ionized lanthanides in yttrium aluminum garnet (YAG) are analyzed theoretically by diagonalizing a parametrized D sub 2 Hamiltonian in a free-ion wave-function basis involving the lowest 10, 11, 9, 10, and 10 J-multiplets respectively of Nd, Eu, Tb, Dy, and Er. The best-fit crystal field parameters for all but Dy are then used to obtain a quadratically smoothed set of parameters for all the lanthanides. It was shown that a coordinate system can be chosen in which the crystal field is primarily D sub 2d. By using the D sub 2d approximation, squared-matrix elements of the electric dipole operator between the Stark split energy states are computed for all the lanthanides in YAG. Author (GRA)

N77-25988# Intelcom Rad Tech, San Diego, Calif.

STUDY OF THE EFFECTS OF RADIATION ON THE ELECTRICAL AND OPTICAL PROPERTIES OF HgCdTe Final Report, 26 Jun. 1975 - 26 Jun. 1976

Charles E. Mallon, Roland E. Leadon, and James A. Naber Griffiss AFB, N.Y. RADC Nov. 1976 134 p refs Sponsored in part by DNA

(Contract F19628-75-C-0170)

(AD-A035055; INTEL-RT-8137-006; RADC-TR-76-351) Avail: NTIS HC A07/MF A01 CSCL 17/5

This report presents the results of an experimental and theoretical investigation of the effects of radiation of the optical and electrical properties of the alloy semiconductor HgCdTe. The objective is to obtain sufficient radiation effects data on detector grade material to enable prediction of the radiation response of detectors fabricated from HgCdTe. GRA

N77-25989# Paris VI Univ. (France). Laboratoire d'Optique des Solides.

INVESTIGATIONS OF SURFACES AND INTERFACES USING OPTICAL EXCITATION OF SURFACE PLASMONS Annual Technical Report, May - Dec. 1976

F. Abeles and T. Lopez-Rios Dec. 1976 56 p refs

(Grant DA-ERO-75-G-027; DA Proj. 1T1-61102-B-11B)

(AD-A035787) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report presents the application of optical excitation of surface plasmons by ATR to investigations of metallic adsorption on metal surfaces prepared and studied under ultra-high vacuum. The experimental set-up and the methods are described. The accuracy of the determination of the surface layer effective dielectric constant is discussed and compared to the accuracy obtained by a differential reflection technique. Preliminary results for very thin deposits of Au on Ag and Ag on Au are given.

Author (GRA)

N77-25990# Illinois Univ., Urbana-Champaign. Dept. of Electrical Engineering.

BULK AND INTERFACE IMPERFECTIONS IN SEMICONDUCTORS Interim Technical Report, Sep. 1974 - Sep. 1975

C. T. Sah Nov. 1976 74 p refs

(Contract F19628-72-C-0199; AF Proj. 5621)

(AD-A035151; RADC-TR-76-341; ITR-3) Avail: NTIS HC A04/MF A01 CSCL 20/12

Some of the eight new techniques, using the space charge layer of a p-n junction, Schottky barrier and a MOS capacitor to determine the properties of imperfection centers, are discussed. These are the depletion layer dark and photo current and capacitance transients, the edge layer dark and photo capacitance transients, the thermally stimulated current and capacitance. A variety of initial charge states of the traps can be set by switching the junction bias, using thermal or photo excitation of the trapped charges, and by injection of the photogenerated carriers on the surface or by injection from a forward biased emitter junction. These new measurement techniques will provide extensive and accurate data on the kinetic parameters of the recombination, generation and trapping processes to improve our understanding of the bound states in semiconductors. They can also be used to monitor silicon integrated circuit processes. GRA

N77-25991# Harry Diamond Labs., Adelphi, Md.

SEMCON: A SEMICONDUCTOR DAMAGE DATA REDUCTION COMPUTER CODE

J. Michael Clodfelter Dec. 1976 88 p

(DA Proj. 1W1-62118-AH-75)

(AD-A034975; HDL-TM-76-28) Avail: NTIS HC A05/MF A01 CSCL 09/1

SEMCON is a semiconductor damage-data-reduction computer code that analyzes various semiconductor devices. The code evaluates semiconductor devices by giving the following information: (1) determination of damage--the failure or nonfailure of a device; (2) calculation of power, energy, and impedance; (3) least-squares fits of specific damage curves to chosen data; (4) selection of the best least-squares fit; and (5)log-log plots of least-squares fits. This report details the development and capabilities of SEMCON, as well as the procedures for using the code. Author (GRA)

N77-25992# State Univ. of New York Research Foundation, Albany.

CRYSTALLOGRAPHIC STUDIES Final Report, 1 Nov. 1972 - 30 Jun. 1976

R. F. Giese Oct. 1976 10 p

(Contract F19628-73-C-0030; AF Proj. 8607)

(AD-A035074; AFGL-TR-76-0264) Avail: NTIS HC A02/MF A01 CSCL 08/7

Mathematical techniques have been developed which permit the computation of hydroxyl orientations, surface energies and diffusion models for water molecules adsorbed on mineral surfaces. These have been applied to several layer silicate and related minerals. Author (GRA)

N77-25993# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.

MICROSTRUCTURAL INVESTIGATION OF POLYCRYSTALLINE IRON WHISKERS

D. S. Lashmore, W. A. Jesser, D. M. Schladitz, H. J. Schladitz, and H. G. F. Wilsdorf Dec. 1976 18 p refs

(Contract N00014-75-C-0855)

(AD-A034989; UVA/525321/MS76/101) Avail: NTIS HC A02/MF A01 CSCL 11/6

The microstructure of polycrystalline iron whiskers produced by chemical vapor decomposition in a magnetic field is found to consist of a core extending the length of the whiskers surrounded by a series of approximately cylindrical layers made up of particles whose diameters are about 1000 angstroms to 3000 angstroms. The grain size in both the core and the surrounding particles is found to be between 50 angstroms to 200 angstroms. The very high strength of these whiskers, 800 MPa, is considered a result of extreme grain refinement strengthening. Author (GRA)

N77-25994# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.

PLASTIC DEFORMATION IN THE NECK OF ALPHA-Fe SINGLE CRYSTALS LEADING TO FRACTURE

R. N. Gardner and H. G. F. Wilsdorf Dec. 1976 20 p refs

(Contract N00014-75-C-0855)

(AD-A034990; UVA/525323/MS76/103) Avail: NTIS HC A02/MF A01 CSCL 11/6

Single crystal iron whiskers have been grown by the reduction of ferrous halides by hydrogen. These crystals have been strained to fracture at various elongation rates at room temperature. Based on stress-strain data, observations of the glide geometry by scanning electron microscopy, and by the X-ray precession method,

various deformation modes have been characterized. We observe that the geometry of the reduction in area is a predictable property of a particular orientation. The hardening rates as well as the reduction in area is found to be dependent upon the number of active slip systems. This, in combination with the results of the precession method provide us with a complete description of the deformation history of these crystals preceding fracture.
Author (GRA)

N77-25995# Virginia Univ., Charlottesville. Dept. of Chemistry.
TETRACARBON METALLOCARBORANES. 1. IRON, NICKEL AND MOLYBDENUM COMPLEXES DERIVED FROM (CH3)4C4B8H8. CRYSTAL STRUCTURE OF (n5-C5H5)Fe (CH3)4C4B7H8
William M. Maxwell, Robert F. Bryan, and Russell N. Grimes Feb. 1977 42 p refs
(Contract N00014-75-C-0305; NR Proj. 053-569)
(AD-A035679; TR-21) Avail: NTIS HC A03/MF A01 CSCL 07/4

Reduction of the carborane (CH3)4C4B8H8 with sodium in tetrahydrofuran produces the apparent (CH3)4C4b8h8 dianion, which in turn reacts with FeC12 and NaC5H5 to generate a series of iron tetracarbon metallocarboranes. The synthesis and characterization of several 12-,13-, and 14-vertex systems containing iron, nickel and molybdenum is described. GRA

N77-25996# Virginia Univ., Charlottesville. Dept. of Chemistry.
TETRACARBON METALLOCARBORANES. 2. THERMAL REARRANGEMENT OF FOURTEEN-VERTEX CAGE SYSTEMS. CRYSTAL STRUCTURES OF THREE TETRACARBON DIFFERRACARBORANE ISOMERS, (n-C5H5)2Fe2(CH3)4C4B8H8
William M. Maxwell, Richard Weiss, Ekk Sinn, and Russell N. Grimes Feb. 1977 54 p refs
(Contract N00014-75-C-0305; NR Proj. 053-569)
(AD-A035680; TR-22) Avail: NTIS HC A04/MF A01 CSCL 07/4

The stereochemistry of 14-vertex polyhedral cages has been explored via a study of the crystal structures of three isomers of (Eta5-C5H5)2Fe2(CH3)4C4B8H8 and their thermal rearrangement. In contrast to other metallocarborane systems, isomerism in these species involves changes in gross polyhedral geometry. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N77-25997# King's Coll., London (England).
PERCOLATION AND CRITICAL BEHAVIOR IN MANY BODY SYSTEMS Final Technical Report, Nov. 1975 - Oct. 1976
C. Domb Oct. 1976 12 p
(Grant DA-ERO-76-G-003)
(AD-A036123) Avail: NTIS HC A02/MF A01 CSCL 20/13

Earlier studies of percolation processes have been extended and the techniques applied to make a comprehensive study of the critical properties of random mixtures in three dimensions. Because of the theoretical interest, particularly in scaling theory, the investigation has been further extended to hyperdimensional mixtures and also to mixtures which are not random but determined by energetic considerations. The basic data has also been used for studies of the lattice gas model and the droplet model of condensation. A method of deriving series expansions for spin glasses has been developed. Thirteen appendices are attached to the original copy of this Technical Report. All are available in the open scientific literature. Copies can also be obtained on request from the controlling office. Author (GRA)

N77-25998# System Development Corp., Huntsville, Ala.
SOLUTION OF THE FUNDAMENTAL PROBLEM OF QUANTUM MECHANICS
Thomas E. Bearden 3 Jan. 1977 25 p refs
(AD-A034237) Avail: NTIS HC A02/MF A01 CSCL 20/10

The fundamental problem of quantum mechanics is posed by Young's two-slit experiment, which is impossible to explain in any classical way. This implies that the solution does not exist in accord with Aristotle's three laws of classical logic; ergo the solution must exist in the negation of those three laws. The author demonstrates a fourth law of logic - the boundary identity of opposites -- and demonstrates how this law may be comprehended. Since the fourth law contains the negation of each of the other three laws, then the four together form a closed operational system (a metalogic). The first three laws apply to individually observed entities while the fourth law applies to multiocular perception. The first three laws deal only with the past, the determined, the singularly exclusive, the localized; while the fourth law deals with the present, the undetermined, the nonexclusive, the nonlocalized, the unperceived/unobserved. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N77-25999*# Oregon State Univ., Corvallis.
MOTHER EARTH, FATHER SKY SYMPOSIUM Final Report
Barbara Bowman 1977 171 p Conf. proc. held at Corvallis, Oregon, 27-28 Apr. 1977; sponsored in part by NASA
(NASA-CR-153250) Avail: NTIS HC A08/MF A01 CSCL 05B

A conference was held in which minority aerospace scientists and engineers interacted with the minority community, particularly at the junior high, high school, and college levels. There were two presentations in the biological sciences, two in the physical and environmental sciences, seven in engineering and computer sciences, and nine in aerospace science and engineering. Aerospace technology careers and aerospace activities were discussed as to how they are relevant to minorities and women. S.M.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-26000# Committee on Science and Technology (U. S. House).
PROGRAM PLANNING AND CONTROL WITH NASA AND THE GAO, PART 1
Washington GPO 1976 30 p Hearing before Subcomm. on Space Sci. and Applications of Comm. on Sci. and Technol., 94th Congr., 2d Sess., No. 62, 18 Mar. 1976
(GPO-70-420) Avail: Subcomm. on Space Science and Applications CSCL 05A

A comprehensive review of NASA program planning and control was undertaken. The data base generated by NASA and under review by GAO was examined. The structure and development of the data base and the plans of action to analyze the large volume of data generated are described. S.M.

N77-26001# European Space Agency, Paris (France). Project Control Div.
PROJECT CONTROL REQUIREMENTS AND PROCEDURES FOR MAJOR PROCUREMENT ACTIONS. PHASE B: SYSTEM DEFINITION
3 Jan. 1977 53 p
(ESA-PSS-32-Issue-1) Avail: NTIS HC A04/MF A01

Requirements and procedures relating to Phase B are stipulated, based on discussions and agreements reached during a series of working group meetings between ESA and EURO-

SPACE on project control, held during 1975 and 1976. These requirements and procedures take into account the experience gained with project control methods applied to satellite procurement actions during recent years. Author (ESA)

N77-26002# European Space Agency, Paris (France). Project Control Div.
PROJECT CONTROL REQUIREMENTS AND PROCEDURES FOR MAJOR PROCUREMENT ACTIONS. PHASE C/D: SYSTEM DEVELOPMENT AND PRODUCTION
3 Jan. 1977 84 p
(ESA-PSS-33-Issue-1) Avail: NTIS HC A05/MF A01

Requirements and procedures relating to Phase C/D are stipulated, based on discussions and agreements reached during a series of working group meetings between ESA and EUROSPACE on project control, held during 1975 and 1976. These requirements take into account the experience gained with the project control methods applied to satellite procurement actions during recent years. Author (ESA)

N77-26003# Boise Center for Urban Research, Idaho.
MINICOMPUTERS: AN ALTERNATIVE APPROACH TO MUNICIPAL INFORMATION SYSTEMS Final Report
Bill DeGroff, Larry Blanchard, and Mike Bliss Jul. 1976 128 p Sponsored in part by National League of Cities/U.S.S. Conference of Mayors, Washington, D. C.
(Contract HUD-H-2196R)
(PB-263775/7; UO-LCCM-BOI-76-004) Avail: NTIS HC A07/MF A01 CSCL 05A

The advantages and disadvantages of the use of minicomputers in management information systems is presented. Boise City concluded that the minicomputer approach to managing data has very distinct and identifiable cost savings over traditional alternatives without sacrificing efficiency and effectiveness. Boise City's decision as a direct result of this research project was to acquire a minicomputer, accept this risk of the current state of minicomputer technology as minimal, and to take advantage of the cost savings. GRA

N77-26004# Coastal Environments, Inc., Baton Rouge, La.
A PROCESS FOR COASTAL RESOURCE MANAGEMENT AND IMPACT ASSESSMENT
Aug. 1976 130 p Sponsored in part by Louisiana State Planning Office
(PB-264811/1; NOAA-77021609) Avail: NTIS HC A07/MF A01 CSCL 13B

Although offshore development may introduce some specialized impacts, such as those resulting from pipelines, other impacts arise from general developments, such as housing, industry and drainage canals supporting offshore activities. A management and planning approach to assessing onshore impacts from offshore development is outlined. GRA

N77-26005# National Science Foundation, Washington, D. C. Div. of Science Resources Studies.
RESEARCH AND DEVELOPMENT IN INDUSTRY, 1974. FUNDS, 1974. SCIENTISTS AND ENGINEERS, JANUARY 1975 Final Surveys of Science Resources Series
John R. Chirichiello, Paul M. White, Robert O. Santos, Wayne M. McCaughey, and Paul Beasley Sep. 1976 91 p Sponsored in part by Bureau of Census
(PB-263779/1; NSF-76-322) Avail: NTIS HC A05/MF A01 CSCL 05A

Data on the dollar volume of research and development performed in the industrial sector, sources of financing, numbers of R and D scientists and engineers, and other economic characteristics of the industrial R and D effort are presented. GRA

N77-26006# National Science Foundation, Washington, D. C. Div. of Science Resource Studies.
NATIONAL PATTERNS OF R AND D RESOURCES: FUNDS AND MANPOWER IN THE UNITED STATES, 1953 - 1976
Apr. 1976 38 p ref
(PB-263778/3; NSF-76-310) Avail: NTIS HC A03/MF A01 CSCL 05A

Trends in the allocation of funds and manpower for basic and applied research by the federal government, industries, universities and colleges, and other nonprofit organizations are discussed, and statistically analyzed. Data presented in tabular form show the dollar volume of research and development performed in each sector, sources of financing, number of R and D scientists and engineers, international comparisons, and other economic characteristics of the nation's R and D effort. GRA

N77-26007# Decisions and Designs, Inc., McLean, Va.
RAPID SCREENING OF DECISION OPTIONS
Judith Selvidge Oct. 1976 107 p refs
(Contract N00014-76-C-0074)
(AD-A035386; TR-76-12) Avail: NTIS HC A06/MF A01 CSCL 05/1

Decision analysis is a formal method for dealing with decision making under uncertainty that takes into account the decision maker's many options, the possible uncertain events that may occur, the probabilities of occurrence of various outcomes of these events, and the decision maker's utility or value for consequences of different combinations of options and outcomes. By means of the format of decision trees or diagrams, the decision situation can be presented graphically and, in particular, the possible decisions and events clearly enumerated and the sequential nature of the decision process shown. This paper discusses a method, applicable to some decision problems, for reducing the analysis to a small, rather manageable set of simple options and a limited number of uncertain outcomes. This technique is called rapid screening of decision options. GRA

N77-26008# Decisions and Designs, Inc., McLean, Va.
ON USING SCENARIOS IN THE EVALUATION OF COMPLEX ALTERNATIVES
Michael F. OConnor and Ward Edwards (Univ. Southern Calif., Los Angeles) Dec. 1976 72 p refs
(Contract N00014-76-C-0074; ARPA Order 3052)
(AD-A035387; TR-76-17) Avail: NTIS HC A04/MF A01 CSCL 05/1

The deployment of large military (or social) systems will occur in an uncertain future, and decisions concerning the design of and choice among alternative systems must therefore involve projections of the expected outcomes of system deployment in such uncertain futures. An attempt to represent the large number of potential alternative futures using an event diagram will result in the bushy-mess problem, often encountered in applications of decision analytic techniques, in which the number of different branches in a probability (or decision) tree is prohibitively large. An alternative to attempting to exhaustively characterize the future in a system evaluation is to evaluate the alternative systems in a reasonable number of hypothetical scenarios. This report is intended as a general discussion of the problem of the use of such scenarios in system evaluation. GRA

N77-26009# California Univ., Berkeley. Operations Research Center.
OPTIMAL DESIGN OF A MANPOWER SYSTEM
Richard C. Grinold Jan. 1977 24 p refs
(Contract N00014-75-C-0619; NR Proj. 047-120)
(AD-A035434; ORC-77-1) Avail: NTIS HC A02/MF A01 CSCL 05/1

An equilibrium model of a manpower system is developed based on the notion of a career flow. Institutional constraints and measures of system performance are linear functions of the career flow. A typical optimal design problem is formulated and a solution procedure is developed. The optimization problem is a generalized linear program in which columns are generated by solving a shortest path problem. Upper and lower bounds on the optimal value function can be developed at each stage of the calculations. Author (GRA)

N77-26010# Naval Ship Research and Development Center, Bethesda, Md.
NAVY LOGISTICS INFORMATION SHARING (NAVLIS) PROJECT Final Report, Jan. 1973 - Jun. 1976
Jun. 1976 469 p ref
(AD-A035847; DTNSRDC-76-0120) Avail: NTIS HC A02/MF A01 CSCL 09/2

The primary objective of the NAVLIS Project was application of computer networking and data base accessing technology to

the current Navy automated logistics environment. The program was terminated in December 1975. This report describes the computer software developed during the construction of a pilot model and the capabilities of that software to extract data from distributed data bases on non-homogeneous computers at geographically dispersed sites. The major technical interests and contributions of the project were Distributed Data Directory concept, Generalized parameter-driven data base interface, Synonym resolution capability and Secondary hit resolution capability. The major recommendations of this report are that NAVLIS Technology be reviewed for its relevance to on-going university level projects, NAVLIS Technology be considered for its potential benefits to other logistics system developments, such as WWMICS and NAICOMMIS, and consideration be given to utilizing the NAVLIS Technology in networking the Navy Data Processing Service Centers. GRA

N77-26011# Defense Systems Management School, Fort Belvoir, Va.

PROTOTYPING: A STRATEGY FOR THE ACQUISITION OF NAVAL AIRCRAFT

Michael Alton Pearce 10 Nov. 1976 80 p refs

(AD-A035357) Avail: NTIS HC A05/MF A01 CSCL 15/5

This study examines the historical uses of the aircraft prototype in the acquisition process, and identifies conditions and events which warrant the use of a prototype strategy in naval aircraft development. Prototyping is evaluated considering service compliance with Department of Defense Directive 5000.1. Prototyping is additionally investigated as an adjunct in meeting current design to cost and life cycle cost objectives. The study concludes that competitive aircraft prototyping can provide significant risk reduction in cost, schedule, performance and source selection. The study recommends that the Naval Air Systems Command adopt and implement a prototype acquisition strategy employing a competitive, critical subsystems prototype during the validation and full scale development phases of future aircraft development. Author (GRA)

N77-26012# Defense Systems Management School, Fort Belvoir, Va.

SUBCONTRACT MANAGEMENT AND LESSONS LEARNED

Ernest W. Rousseau Nov. 1976 29 p refs

(AD-A037074) Avail: NTIS HC A03/MF A01 CSCL 05/1

For a number of years, a major Air Force space program was faced with the problem of having to procure a critical subsystem from a sole source subcontractor. The primary reason for his monopoly was a proprietary process used in his commercial business. The cost associated with meeting the vendor's ever increasing demands was unacceptable and dictated management action. A prototype competition was conducted and resulted in the selection of a new vendor. Associated with this was improved technology, lower cost and better response to schedule requirements. The original subcontractor sued the government and lost. The litigation did however, provide some important 'lessons learned.' Described in the report is the evolution of the problems, relation between the prime contractor and the government in arriving at a solution, the litigation and lessons that were provided. Author (GRA)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N77-26013*# Teledyne Brown Engineering, Huntsville, Ala. Systems Div.

STUDY OF SYSTEMS AND TECHNIQUES FOR DATA BASE MANAGEMENT Interim Report

Dec. 1976 61 p

(Contract NAS8-31488)

(NASA-CR-150278; SD76-MSFC-2060) Avail: NTIS HC A04/MF A01 CSCL 05B

Data management areas were studied to identify pertinent problems and issues that will affect future NASA data users in terms of performance and cost. Specific topics discussed include the identifications of potential NASA data users other than those normally discussed, consideration affecting the clustering of minicomputers, low cost computer system for information retrieval and analysis, the testing of minicomputer based data base management systems, ongoing work related to the use of dedicated systems for data base management, and the problems of data interchange among a community of NASA data users. Author

N77-26014# Pennsylvania Science and Engineering Foundation, Harrisburg.

AN OPERATIONAL EXPERIMENT FOR THE MARKETING OF SCIENTIFIC AND TECHNICAL INFORMATION INNOVATIONS Final Report, May 1974 - Sep. 1975

John F. Grashof May 1976 117 p refs

(Grants NSF GN-42271; NSF SIS-74-08626-A01)

(PB-261578/9) Avail: NTIS HC A06/MF A01 CSCL 05B

The markets for STI and general marketing approaches to meet these needs were identified. A two-phase research program was used. The first phase consisted of an informal investigation of the market for STI, the products and services currently available, and the marketing approaches that had been developed. Phase two was a major segmentation study of 274 persons in 171 manufacturing firms in Pennsylvania. GRA

N77-26015# Stanford Research Inst., Menlo Park, Calif.

REQUIREMENTS AND ALTERNATIVE DESIGNS FOR AUTOMATING THE PUBLICATION OF NAVSEA MOTD AT THE NSDSA Final Report, 1 Jul. - 30 Nov. 1976

Jack J. Bialik and Patricia Whiting-OKeefe Jan. 1977 154 p

(Contract N00014-76-C-0407)

(AD-A036122; SRI-4739-7) Avail: NTIS HC A08/MF A01 CSCL 05/2

The United States Navy is currently in the initial phase of the Navy Technical Information Presentation Program (NTIPP), which is intended to modernize the generation, maintenance, publication, and distribution of MOTD on a Navy-wide basis. At the same time, NAVSEA, with an extremely large MOTD production requirement, is in the process of improving its own production capabilities. This report analyzes the ability of the current NSDSA publication support system (ADPREPS) to supply those requirements, and the alternative technical approaches that might be used to satisfy the NSDSA's growing requirements in the near future. The near future is defined as a period three to four years after the issuance of this report. The investigations were all placed within the context of the NTIPP. The manner in which the NSWSES publication system modernization program will be compatible with the later NTIPP developments was a major consideration. GRA

N77-26016# Office of Telecommunications, Washington, D. C.

THE INFORMATION ECONOMY: USER'S GUIDE TO THE COMPLETE DATABASE (ON MAGNETIC TAPE) Final Report

Michael R. Rubin Mar. 1977 71 p

(Grant NSF APR-76-09015)

(PB-264173/6; OT-SP-77-12-9-DOC; COM-DF-77-001A) Avail: NTIS HC A04/MF A01 CSCL 05B

A user's guide to the magnetic tape containing economic data on the U.S. economy in the benchmark year 1967 is presented. The information sector of the economy is highlighted in two input-output tables, one at the 108 industry order, and the other at the 190 order level. A coefficient and inverse tables are also included for both industry schemes. In addition, tables of employee compensation by industry and by occupation for 1967 and 1970 are included. GRA

N77-26017# State Univ. of New York, Albany. Comparative Development Studies Center.

COMPARATIVE LEGISLATIVE INFORMATION SYSTEMS: THE USE OF COMPUTER TECHNOLOGY IN THE PUBLIC POLICY PROCESS

John A. Worthley 1976 178 p refs Sponsored by NSF

(PB-263848/4; NSF/RA-760122) Avail: NTIS

HC A09/MF A01 CSCL 05B

Computer techniques used in legislative information systems in Canada, Great Britain, and five U. S. state governments are described. The nature of the data required for analysis of legislative efforts is discussed, as well as suggested approaches for applying and adapting computer technology to the legislative process. GRA

N77-26018# Battelle Columbus Labs., Ohio.
TECHNOLOGY ASSESSMENT OF INFORMATION NETWORKING TECHNOLOGY Final Report, 15 May 1975 - 15 Dec. 1976
W. D. Penniman 15 Dec. 1976 126 p refs
(Contract NSF C-1016)
(PB-264188/4) Avail: NTIS HC A07/MF A01 CSCL 05B

The major technological, socio-political, legal, and economic forces which can influence the future evolution of science and technology research and development information networks, and the effects of the networks on society from 1975-1985 were identified and assessed. Major policy considerations are outlined and their implications discussed. Recommendations are made for future indepth studies. GRA.

N77-26019# Texas Univ., Austin. Center for Cybernetic Studies.
SOME CONSIDERATIONS AND MODELS FOR THE DISTRIBUTION OF A DATA BASE
Joyce Elam and Joel Stutz May 1976 37 p refs
(Contracts N00014-75-C-0569; N00014-75-C-0616; NR Proj. 047-021)
(AD-A035923; CCS-279) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper presents a survey of current research in the area of distributed systems and discusses some possible areas of future research. The trend toward data base management systems which are responsible for the creation, accessing, and maintenance of a large collection of information containing complex interrelationships is prevalent in centralized systems today. It seems that the same advantages which led to the growth of data base management systems in centralized systems can be applied in distributed systems as well. Most current research, particularly in the area of modeling, views a distributed system in terms of independent data files. The authors address some of the problems involved when the distributed system is viwed in terms of an integrated data base. GRA

N77-26020# Naval Ship Research and Development Center, Bethesda, Md.
DATA BASE DESIGN
David K. Jefferson Jun. 1976 105 p refs
(TF53531009)
(AD-A035945; DTNSRDC-76-0111) Avail: NTIS HC A06/MF A01 CSCL 09/2

In the four principal activities of data base design, (1) Identifiers and descriptors must be grouped together to form logical records. A suggested standard form and procedure for obtaining this form are described. (2) Relationships among logical records must be established by logical access paths. The hierarchical, CODASYL, and relational models and the situations in which they are applicable are described. (3) The physical form of records must be determined. Several techniques for reducing storage requirements are described. (4) The physical realizations of logical access paths must be determined. A general technique is described, examples are presented and evaluated, and specific suggestions are made for many different types of applications. Author (GRA)

N77-26021# Battelle Columbus Labs., Ohio.
THE EVALUATION AND SYSTEMS ANALYSIS OF THE SYSTRAN MACHINE TRANSLATION SYSTEM Final Technical Report, Nov. 1974 - Aug. 1976
T. C. Halliday and E. A. Briss Griffiss AFB, N. Y. RADC Jan. 1977 80 p refs
(Contract F30602-75-C-0078)
(AD-A036070; RADC-TR-76-399) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report is the product of contractual effort to determine how machine translations produced by SYSTRAN can be improved upon and where to integrate the required correctional procedures. Two tasks were pursued: the first, a survey of SOTA in translation evaluation methods; the second, the actual determination of translation deficiencies and identification of correctional procedures. The survey did not produce any new methods of evaluation, and it was already known that the old procedures tested quality characteristics but did not identify deficiencies. Consequently, a method was adopted which did meet the requirements to achieve the objectives of the contractual effort. Russian source material from Mechanical Engineering and Metallurgy were selected for translation using a base-line SYSTRAN configuration. One sample of each was translated and then corrected by a bilingual expert in each field. Two types of corrections were considered implementable, stem dictionary update and semantic expression update. The same samples were re-translated incorporating first the updated stem dictionary and then both it and the updated semantic expressions dictionary. Improvements to sentences under each condition were recorded. Also, a different sample from each field was translated by the base-1 line configuration and each updated version to maintain control of carry-over effects that may occur due to updating. Overall results across both subject areas show a 50% improvement in the sample of sentences when the stem dictionary is updated and 56% when the semantic expression update is included in translation. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N77-26022# National Science Foundation, Washington, D. C. Div. of Science Resource Studies.
THE 1985 R AND D FUNDING PROJECTIONS Progress Report, 1953 - 1985
Jun. 1976 36 p refs
(PB-263856/7; NSF-76-314) Avail: NTIS HC A03/MF A01 CSCL 05C

Data are presented on the dollar volume of research and development performed within each sector of the economy, by source of financing for 1985. Also presented are forecasts of the gross national product and sales. GRA

N77-26023# DARCOM Intern Training Center, Texarkana, Tex.
COMPUTER AIDED COST ESTIMATION FOR PRODUCTION ENGINEERS Final Report
Calvin Gregory Scott Mar. 1976 113 p refs
(AD-A035823; DARCOM-ITC-02-08-76-203) Avail: NTIS HC A06/MF A01 CSCL 14/1

This report develops a computer system which will allow an engineer to utilize the computer to aid him in preparing a cost estimate. Input to the programs is detailed information on the production process being analyzed. Included in the input are manufacturing operation times, material costs, tooling costs, labor costs, and various indirect fees associated with the manufacturing process. The output includes two reports. The first is a detailed report on each operation, and the second is a summary sheet summarizing the costs of an operation. Author (GRA)

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N77-26024# Committee on Commerce, Science, and Transportation (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1978, PART 2
Washington GPO 1977 648 p refs Hearings on S. 365 before Subcomm. on Sci., Technol., and Space of the Comm. on Commerce, Sci., and Transportation, 95th Congr., 1st Sess., 25 Feb., 1 and 3 Mar. 1977
(GPO-86-914) Avail: Subcomm. on Sci., Technol., and Space

The testimony of witnesses and additional articles, letters, and statements are presented in support of NASA budget requests. A.R.H.

N77-26025 Committee of Conference (U. S. Congress).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION, FISCAL YEAR 1978
Washington GPO 1977 12 p Conference rept. to accompany H.R. 4088 from Comm. of Conference, 95th Congr., 1st Sess., 21 Jun. 1977
(S-Rept-95-281; GPO-89-010) Avail: US Capitol, Senate Document Room

An amendment is presented for resolving disagreeing votes of the House and Senate on the Senate amendment to H.R. 4088. Appropriations to be authorized for NASA research and development, construction of facilities, and research and program management are presented and discussed. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N77-26026*# Technology and Economics, Inc., Cambridge, Mass.
URBAN CONSTRUCTION AND SAFETY PROJECT Quarterly Report, May - Jun. 1975
Jun. 1975 42 p
(Contract NAS9-14529)
(NASA-CR-153245; QR-2) Avail: NTIS HC A03/MF A01 CSCL 05A

The purpose and functions of NASA technology applications temas (TAT) are described, with emphasis on the activities of the Urban and Construction and Safety Project. The transfer and implementation of technology is discussed in five activities. Topics include: flat conductor cable, NASA house and compendium, flood insurance studies, tornado studies, and the controller for stationary diesels. Author

N77-26027*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MIUS INTEGRATION AND SUBSYSTEMS TEST PROGRAM
Willie S. Beckham, Jr., Gerald C. Shows, Tony E. Redding, Richard C. Wadle, Martin B. Keough, and Jerry C. Poradek Dec. 1976 151 p refs
(NASA-TM-X-58187; JSC-11402) Avail: NTIS HC A08/MF A01 CSCL 05A

The MIUS Integration and Subsystems Test (MIST) facility at the Lyndon B. Johnson Space Center was completed and ready in May 1974 for conducting specific tests in direct support of the Modular Integrated Utility System (MIUS). A series of subsystems and integrated tests was conducted since that time, culminating in a series of 24-hour dynamic tests to further demonstrate the capabilities of the MIUS Program concepts to meet typical utility load profiles for a residential area. Results of the MIST Program are presented which achieved demonstrated plant thermal efficiencies ranging from 57 to 65 percent. Author

N77-26028# Voorhees (Alan M.) and Associates, Inc., McLean, Va.
STUDY OF FUTURE PARATRANSIT REQUIREMENTS Final Report
Jan. 1977 278 p refs
(PB-264082/9; UMTA-IT-06-0104-77-2) Avail: NTIS HC A13/MF A01 CSCL 13B

A range of paratransit service concepts in context with a set of typical urban settings under three alternative 1995 futures are examined. These alternative futures are described in terms of energy cost and degree of automobile disincentives. Integrated transit and paratransit systems are defined and match a combination of transit and paratransit services with forcasted transportation needs for each individual setting. Using estimated representativeness factors for each setting, the setting results are expanded to provide order-of-magnitude nation-wide estimates of potential future paratransit activity. These estimates are presented in terms of passenger demand, subsidy requirements, and vehicle requirements. GRA

N77-26029# Mitre Corp., McLean, Va.
ENVIRONMENTAL IMPACT ISSUES FOR AUTOMATED GUIDEWAY TRANSIT SYSTEMS
E. Nussbaum and B. Zumwalt Aug. 1976 144 p refs
(Contract DOT-UT-50016)
(PB-263640/5; UMTA-VA-06-0025-77-2; MTR-7268) Avail: NTIS HC A07/MF A01 CSCL 13B

Some of the critical non-engineering issues that influence social acceptability of AGT in the urban areas, such as, crime, system safety, and community disruption are discussed. Concepts presented reflect on the opinion of a variety of recent publications, including the environmental impact statement guidelines of a number of Federal Government agencies. Twenty-three impact areas that influence social acceptability of AGT in urban areas are listed. For each of these areas, representative possible impacts, system sources, and solutions are presented. GRA

N77-26030# International Road Federation, Washington, D.C.
THE 1976 WORLD SURVEY OF CURRENT RESEARCH AND DEVELOPMENT ON ROADS AND ROAD TRANSPORT Annual Road, 1976
Dec. 1976 503 p
(Contract DOT-FH-11-8893)
(PB-264430/0; FHWA/RD-77-12) Avail: NTIS HC A22/MF A01 CSCL 13B

There are 5,430 projects listed, classified in accordance with the subject area classification system of the Transportation Research Board. GRA

N77-26031# Municipal Environmental Research Lab., Cincinnati, Ohio.
THE COST OF REMOVING CHLOROFORM AND OTHER TRIHALOMETHANES FROM DRINKING WATER SUPPLIES
Robert M. Clark, Daniel L. Guttman, John L. Crawford, and John A. Machisko Mar. 1977 114 p refs
(PB-264283/3; EPA-600/1-77-008) Avail: NTIS HC A06/MF A01 CSCL 13B

Costs associated with the use of activated carbon, ozonation, aeration, and chlorine dioxide for removal of trihalomethanes are presented for the development of planning estimates rather than for the preparation of bid documents or detailed cost estimates. Data are presented in such a way as to enable the planner to make adjustments to the reported costs when local information is available. Standardized levels for a selected set of design parameters are assumed and sensitivity analysis is performed for the majority of the parameters. GRA

N77-26032# Clemson Univ., S.C. Water Resources Research Inst.
IMPROVED WASTE-TREATMENT SYSTEMS DESIGN BASED ON THE NATURAL THERMAL ENVIRONMENT
Linvil G. Rich Jul. 1976 99 p refs
(Contracts DI-14-31-0001-5041; DI-14-34-0001-6042)
(PB-264042/3; WRRI-64; W77-05004; OWRT-A-035-SC(1))
Avail: NTIS HC A05/MF A01 CSCL 13B

The importance and relationship of temperature to process kinetics in biological waste treatment is discussed. Data and methodology are given for determining ground and surface water temperature. The biological kinetics associated with the removal of organic pollutants in lagoons and means for quantifying temperature effects are described. The relationship of the natural thermal environment to meteorological factors such as solar radiation, evaporation, and wind velocity is explored. GRA

N77-26033# Environmental Protection Agency, Washington, D. C. Office of Solid Waste Management Programs.
MANAGEMENT OF METAL-FINISHING SLUDGE
E. P. Crumpler, Jr. Feb. 1977 67 p refs
(PB-263946/6; EPA/530/SW-561) Avail: NTIS

HC A04/MF A01 CSCL 13B

The disposal of metal-bearing sludges from treatment of metal finishing wastewaters was considered. The state-of-the art of technology which can potentially manage the sludge is discussed. Disposal techniques, recycle and waste reduction technology are reviewed. The major advantages and disadvantages of each technique are presented. GRA

N77-26034# Missouri Water Resources Research Center, Columbia.

IMPROVING INFORMATION DISSEMINATION AND TECHNOLOGY TRANSFER IN THE WATER RESOURCES FIELD Completion Report

Richard L. Lee and Eugene Ferraro 15 Dec. 1976 89 p refs (Contract DI-14-31-0001-4269; OWRT Proj. X-145-MO(4269)(1))

(PB-264210/6; W77-05102) Avail: NTIS HC A05/MF A01 CSCL 14B

An application of motion picture communication to solving the problem of communicating water research results to the public is described. Communication theory was applied to motion picture production for use in an information dissemination program for water resources. A documentary film, RIVERS, and a series of three news film clips on specific water research projects were produced and distributed via various channels to the general public. GRA

N77-26035# Du Pont de Nemours (E. I.) and Co., Wilmington, Del.

ONE PASS SEAWATER DESALTING RO PILOT PLANT EVALUATION Final Report

P. P. Goodwyn Jun. 1976 101 p refs

(Contract DI-14-34-0001-6507)

(PB-262207/4; W77-03076; OWRT/S-77/1) Avail: NTIS HC A06/MF A01 CSCL 13B

Three modes of biological fouling control for reverse osmosis seawater systems are discussed. Modes tested were: (1) chlorination followed by carbon dechlorination; (2) chemical dechlorination with sodium bisulfite instead of carbon; (3) ultraviolet (UV) irradiation instead of chlorination/dechlorination. Polyamide hollow fiber reverse osmosis permeators operating at 800 psi and desalting seawater in a single stage were used. Collectively, the RO test systems produced about 15,000 gpd of potable water. Either UV or chlorine treatment with bisulfite dechlorination was as effective as chlorination with carbon treatment in maintaining stable performance. GRA

N77-26036# Lansing Planning Dept., Mich.

TRANSPORTATION SERVICES INTEGRATION PROJECT. FINAL RECOMMENDATIONS AND IMPLEMENTATION PLAN Final Report, Aug. 1974 - Jul. 1976

Alan E. Tubbs and Kunwar Rajendra Jun. 1976 162 p refs Sponsored by Urban Mass Transportation Admin., Chicago

(PB-263649/6) Avail: NTIS HC A08/MF A01 CSCL 13B

Methods are proposed for coordinating activities of special transportation agencies involved in serving the elderly, handicapped and low-income populations in Eaton, Clinton, and Ingham counties. Topics discussed include: rules for participation in a coordinated system, role of the Central Coordinating Agency, procedures for making services available to a general user and/or clients of an agency, results of an experimental set up for coordination of services and fare structure. GRA

N77-26037# Universities Council on Water Resources, Lincoln, Nebr. Technology Transfer Committee.

WATER RESOURCES TECHNOLOGY TRANSFER, A GUIDE

William E. Sharpe, Ralph R. Huffsey, Waldon R. Kerns, James M. Stewart, Jon C. Dyer, Jack C. Jorgensen, Lyle S. Raymond, Jr., and Glenn E. Stout Jan. 1977 29 p refs Prepared in cooperation with Penn. State Univ., University Park)

(Contract DI-14-34-0001-6702)

(PB-263704/9; W77-04346; OWRT-T-0003(6702)(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

Procedures for conducting technology transfer programs using, effective and appropriate communication media are described. Techniques included are: news release, public service television, radio programming, newsletters, films and video tapes, displays and exhibits, trade journals and organizational publications, pamphlets, brochures and bulletins, manuals, seminars, short courses and conferences, and personal contact. Guidelines are given for developing and evaluating technology transfer programs. A model institute program is outlined. Eleven recommendations are included for fulfilling the technology transfer mandates of the 1971 Amendments to the Water Resources Research Act. GRA

N77-26038# Washington Univ., Seattle.

RESEARCH NEEDS IN ENVIRONMENTAL DESIGN AND CONTINUITY Conference Summary

Richard L. Ludwig Aug. 1976 50 p Conf. held at Issaquah, Washington, 1-3 Jun. 1976

(Grant NSF ENV-76-18494)

(PB-262347/8; NSF/RA-760210) Avail: NTIS HC A03/MF A01 CSCL 13B

Research priorities in environmental design were identified. Three major categories of research need emerged: (1) the analytical methods of the environmental designer need to be developed; (2) substantive research needs to be done in the areas of person-environment relationships, environmental change, and the governmental context of environmental design; and (3) improvement of methods for conveying to the lay public, elected officials, and design professionals information necessary for resolving conflicts in environmental design issues as well as developing means for disseminating information/research within the field. GRA

N77-26039# Gellman Research Associates, Inc., Jenkintown, Pa.

INDICATORS OF INTERNATIONAL TRENDS IN TECHNOLOGICAL INNOVATION Final Report, 1953 - 1973

Stephen Feinman and William Fuentevilla Apr. 1976 329 p refs

(Contract NSF C-889)

(PB-263738/7; NSF/SIU-76-1) Avail: NTIS HC A15/MF A01 CSCL 05A

Indicators of the international trends in technological invention and innovation were developed. A qualitative data base for 500 technological innovations introduced into the marketplace between 1953 and 1973, in any one of six countries was evaluated. The factors explored included: (1) the industry which introduced the innovation in terms of three digit SIC numbers; (2) the country of market introduction; (3) the date of market introduction; (4) the market addressed by the innovator; (5) the size of the firm in terms of employees and sales; (6) the structure of the company; and (7) the background of senior management. GRA

N77-26040# Naval Ship Research and Development Center, Bethesda, Md.

EVALUATION OF SINGLE PASS SEAWATER REVERSE OSMOSIS MODULES AND PRETREATMENT TECHNIQUES, PHASE 2

J. F. Pizzino Feb. 1977 18 p refs

(AD-A035773; DTNSRDC-77-0011) Avail: NTIS HC A02/MF A01 CSCL 13/2

An experimental 200-gallon-per-day, single pass, reverse osmosis desalination system was operated on natural, unacidified seawater to evaluate the performance of ultrafiltration and diatomaceous earth filtration as particulate removal techniques for seawater feed. Chlorine produced electrolytically from sea water was used to disinfect the feedwater. Results showed diatomaceous earth filtration to be an effective method of particulate removal for seawater. The ultrafiltration system at times provided satisfactory filtration but was found to be somewhat unreliable. Bacteriological analyses showed that electrolytically produced chlorine was effective in killing bacteriological species in the seawater feed, including coliform, and that the resulting reverse osmosis permeate was bacteriologically safe for human consumption. Throughout the duration of the evaluation, permeate total dissolved solids remained below the maximum acceptable level of 500 parts per million. Investigations of alternative filtration techniques are recommended to develop an acceptable filtration method that does not require a consumable filter media such as diatomaceous earth aboard ship. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-26041# Lockheed Missiles and Space Co., Palo Alto, Calif.
OBSERVATIONS OF THE SCORPION X-1 FROM THE SALIUT-4
E. I. Moskalenko 1977 3 p Transl. into ENGLISH from Priroda (Moscow), no. 4, Apr. 1977 p 130-132
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago Illinois 60616

The data of optical observations of the Scorpion X-1 was analyzed for the last sixty years by using an electronic computer. Processing the data confirmed the presence of a regular optical variability whose amplitude is the approximately 20% in the background of the chaotic brilliance changes for which the magnitude of the flux varies almost threefold. The period of brilliance fluctuation is 0.78 days. The assumption that Scorpion X-1 is a double system was probed. Estimates of the mass of the components of this system result in values on the order of the mass of the sun. Author

N77-26042# Royal Observatory, Edinburgh (Scotland).
UBV PHOTOGRAPHIC PHOTOMETRY IN AND AROUND THE GALACTIC CLUSTER NGC 2527
R. J. Dodd 1977 13 p refs
(ROE-OR-3) Avail: NTIS HC A02/MF A01

A multicolor photometric investigation, based on Schmidt telescope plates, of the region centered on l = 250 deg in the galactic plane is reported. The procedures adopted for the reduction of iris diaphragm photometer readings to photographic magnitudes and colors are outlined, and results of the reduction are presented. ESA

N77-26043# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
MATHEMATICAL MODELS FOR GEODETIC ASTRONOMY [MATHEMATISCHE MODELLE DER GEODAETISCHEN ASTRONOMIE]
Siegfried Heitz 1976 133 p refs In GERMAN
(Ser-A-85-Mitt-138) Avail: NTIS HC A07/MF A01

Methods used in geodetic astronomy, and the significance of their results in the solution of geodetic problems, are discussed. The mechanical fundamentals of astrometric and geodetic coordinate systems are described. The definition and transformation of astrometric and geodetic coordinate systems are considered. Systems of time measurement are surveyed. FORTRAN subroutines are given for precession-nutation and solar ephemerides. ESA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N77-26044*# Stanford Univ., Calif. Inst. for Plasma Research.
PARTICLE ACCELERATION IN AXISYMMETRIC, MAGNETIZED NEUTRON STARS
K. B. Baker and P. A. Sturrock May 1977 19 p refs
(Grant NGR-05-020-668)
(NASA-CR-153213; SU-IPR-695) Avail: NTIS HC A02/MF A01 CSCL 03B

The potential drop in the polar cap region of a rotating, magnetized neutron star is found assuming that the magnetic field is dipolar, with the field aligned (or anti-aligned) with the rotation axis. The curvature of the field lines is of critical importance. Charge flow is assumed to be along magnetic field lines. The electric field has a maximum at radius 1.5 R and the magnitude and functional form of the current is determined. Author

N77-26045*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA-RAYS AND THE CASE FOR BARYON SYMMETRIC BIG-BANG COSMOLOGY
F. W. Stecker Apr. 1977 8 p refs Submitted for publication
(NASA-TM-X-71322; X-602-77-91) Avail: NTIS HC A02/MF A01 CSCL 03B

The baryon symmetric big-bang cosmologies offer an explanation of the present photon-baryon ratio in the universe, the best present explanation of the diffuse gamma-ray background spectrum in the 1-200 MeV range, and a mechanism for galaxy formation. In regard to He production, evidence is discussed that nucleosynthesis of He may have taken place after the galaxies were formed. Author

N77-26046# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
A METHOD FOR DETERMINATION OF ELLIPTICAL KEPLER ORBITS FROM TWO POSITION VECTORS [EIN VERFAHREN ZUR BESTIMMUNG VON ELLIPTISCHEN KEPLER-BAHNEN AUS ZWEI ORTSVEKTOREN]
H. G. Peters Oct. 1976 30 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Rept-7-76) Avail: NTIS HC A03/MF A01

As a starting approximation for determining earth satellite orbits from observation values, the Kepler orbit corresponding to the measured values is normally used. The Gaussian method of determining a Kepler orbit using two position vectors diverges if the angle between the two vectors is larger than 70 deg (for orbits with an eccentricity which is not too large). A transcendental equation is presented for the difference of the eccentric anomalies, in the form Delta E = f(Delta E) in which a solution exists for every angle size. An estimation of the differential quotient for the function f is derived. Author (ESA)

N77-26047# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
A METHOD FOR DETERMINING MEAN ORBITAL ELEMENTS OF AN EARTH SATELLITE FROM DIRECTION, RANGE AND DOPPLER MEASUREMENTS AT TWO DIFFERENT TIMES [EIN VERFAHREN ZUR BESTIMMUNG DER MITTLEREN BAHNELEMENTE EINES ERDSATELLITEN AUS RICHTUNGS-, ENTFERNUNGS- UND DOPPLERMESSUNGEN ZU ZWEI VERSCHIEDENEN ZEITEN]
H. G. Peters Oct. 1976 18 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(Rept-8-76) Avail: NTIS HC A02/MF A01

A procedure to determine mean orbital elements of earth satellites from two topocentric position vectors plus Doppler measurements is described. This procedure is iterative and generally starts with the Kepler approximation. Doppler measurements limit the number of quantities to be iteratively corrected to two. This method utilizes the fact that the energy and a rotation impulse component represent motion constants (and are, naturally, functions of the mean orbital elements). In the case of orbits of smaller eccentricity, classical orbital elements are replaced by orbital parameters which do not have singularities. The perturbations, according to the Brouwer theory, are transformed for these orbital parameters. Author (ESA)

N77-26048# Chicago Univ., Ill. Lab. for Astrophysics and Space Research.
A THEORETICAL INVESTIGATION OF SOLAR WIND-MAGNETOSPHERE INTERACTIONS AND ASTROPHYSICAL PLASMA PHENOMENA Final Report, 1 Nov. 1974 - 30 Sep. 1976
Ian Lerche 1 Nov. 1976 19 p refs
(Contract F19628-75-C-0101)
(AD-A035075; AFGL-TR-76-0272) Avail: NTIS HC A02/MF A01 CSCL 03/2

The research reported here is directed towards an understanding of solar windmagnetosphere interactions and astrophysical plasma phenomena. Since approximately twenty-five (25) scientific papers were produced during the tenure of this contract we give here a complete list of the papers (by title and Journal) produced during this contract together with abstracts where available (two of the papers were papers presented at conferences, and one is an invited review of others' work; for these we do not deem it worthwhile to give abstracts). In essence the research can be divided into three catagories. First, some of the basic plasma physics of the cosmic rays transported to earth has been considered in order to ascertain the behavior of such particles under the diverse conditions can be obtained in the interplanetary medium. Second, there is the sequence of papers dealing with the propagation through, and reflection from, differentially moving media. The motivation here was originally suggested by the escape of radiation from pulsar magnetospheres but the problem is of more general interest. It has application to radar backscatter from the ionosphere, and to radiation passing through both the interplanetary medium and the magnetosphere. Finally there is the work on the pair production in strong magnetic fields which is a process often invoked to account for the observed emission from pulsars. There are also several isolated papers dealing with miscellaneous topics. Of these the work on blast wave theory applied to supernova remnants has progressed considerably further since our earlier work on the subject reported here under the category of papers to be published.

Author (GRA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-26049*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SIMILARITY LAWS OF LUNAR AND TERRESTRIAL VOLCANIC FLOWS

S. I. Pai (Maryland Univ., College Park), Y. Hsu (Maryland Univ., College Park), and John A. OKeefe [1977] 36 p refs

(NASA-TM-X-72610) Avail: NTIS HC A03/MF A02 CSCL 03B

A mathematical model of a one dimensional, steady duct flow of a mixture of a gas and small solid particles (rock) was analyzed and applied to the lunar and the terrestrial volcanic flows under geometrically and dynamically similar conditions. Numerical results for the equilibrium two phase flows of lunar and terrestrial volcanoes under similar conditions are presented. The study indicates that: (1) the lunar crater is much larger than the corresponding terrestrial crater; (2) the exit velocity from the lunar volcanic flow may be higher than the lunar escape velocity but the exit velocity of terrestrial volcanic flow is much less than that of the lunar case; and (3) the thermal effects on the lunar volcanic flow are much larger than those of the terrestrial case. Author

N77-26050# Academy of Sciences (USSR), Moscow. Space Research Inst.

PLASMA OBSERVATIONS NEAR VENUS ONBOARD THE VENERA 9 AND 10 SATELLITES BY MEANS OF WIDE-ANGLE PLASMA DETECTORS

K. I. Gringauz, V. V. Bezrukikh, T. K. Breus, T. Gombosi (Central Res. Inst. for Phys., Budapest), A. P. Remizov, M. I. Verigin, and G. I. Volkov 1976 33 p refs

(D-229) Avail: NTIS HC A03/MF A01

Low energy plasma measured by means of wide-angle detectors onboard Venera 9 and Venera 10 space probes launched into Venus orbits (perigee 1,500 km, apogee 110,000 km) in October 1975 are presented. Stable electron and fluctuating ion fluxes were detected in the optical and corpuscular umbra. As a result of the plasma characteristics observed at a few hundred kilometers above the optical umbra, this region is referred to as corpuscular penumbra. Using a number of bow shock crossings, corpuscular structure was analyzed. The relatively small fluctuation of the bow shock crossing positions and grouping of corresponding shocks near the planet suggest the non-magnetic nature of the Venus obstacle. Author (ESA)

N77-26051# Academy of Sciences (USSR), Moscow. Space Research Inst.

IDENTIFICATION OF CO MOLECULE IN THE NIGHT AIRGLOW SPECTRUM OF VENUS

V. I. Slysh 1976 10 p refs

(D-241) Avail: NTIS HC A02/MF A01

Using Venera 9 spectrometer measurements, a night airglow of Venus was evidenced. A spectrum consisting of eight bright bands in the wavelength range from 3,600 to 6,500 A was analyzed, and CO molecular spectra was identified in the night airglow of Venus. A mechanism is proposed analog to the earth aurora mechanism. ESA

N77-26052# Academy of Sciences (USSR), Moscow. Space Research Inst.

SPECTROSCOPY OF THE VENUS NIGHT AIRGLOW FROM THE VENERA 9 AND 10 SATELLITES

V. A. Krasnopolsky, A. A. Krysko, V. N. Rogachev, and V. A. Parshev 1976 18 p refs

(D-243) Avail: NTIS HC A02/MF A01

The spectrometers installed on board the Venera 9 and 10 stations had the following characteristics: spectral range 3,000 to 8,000 A, spectral resolution 20 A, field of view 12 min, sensitivity threshold 30 Rayleighs, dynamic range 30,000, and time of spectrum registration 2.5 sec. The night airglow spectra were obtained; they involve more than 10 emissions belonging to one system of molecular bands. The intensity of this system is 100 kilo Rayleighs at planetary limb. The airglow is concentrated in the layer of 6 + or - 2.5 km thickness at 90 + or - 5 km. The diurnal variation of airglow is characterized by zenith intensity 4 kR at the hour angle t equals 310 deg, by its increasing towards the midnight up to 7 kR at t equals 345 deg and by subsequent decreasing down to 1.5 kR at t equals 65 deg. It can be explained under assumption on recombination of atomic oxygen in triple collisions with CO2 as a source of the Venus atmosphere glow at night. Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-26053*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

ANALYSIS OF SIMULTANEOUS SKYLAB AND GROUND BASED FLARE OBSERVATIONS Final Summary Report

J. L. Kulander Dec. 1976 82 p refs

(Contract NASw-2854)

(NASA-CR-153029; LMSC-D553908) Avail: NTIS HC A05/MF A01 CSCL 03B

HeI and HeII resonance line data from Skylab were reduced, analyzed and compared with HeI D3 line intensities taken simultaneously from the Lockheed Rye Canyon Solar Observatory. Computer codes were developed for the calculation of total He line intensities and line profiles from model flare regions. These codes incorporate simultaneous solution of the line and continuum transport equations as needed together with the statistical equilibrium equations for a 30 level HeI, HeII, HeIII system. The energy level model consists of all terms through principal quantum number four. Interpretation of the observed data in terms of these parametric solutions and with simultaneous solution of the transport equations are discussed. Author

N77-26054*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Electro-Optics Lab.

ANALYSIS OF H-ALPHA FLARE SPECTRA Final Report

J. L. Kulander Jan. 1977 89 p refs

(Contract NAS8-31777)

(NASA-CR-150279; LMSC-D558824) Avail: NTIS

HC A05/MF A01 CSCL 03B

Spectrographs of the H-alpha line taken at 15 second intervals from the event of 5 Sept. 1973 were interpreted by comparison with synthetic profiles. A sequence of 27 high resolution H alpha profiles was obtained from the second brightest flare kernel. The profiles were generally self reversed with a maximum peak intensity of 1.16 x continuum and a maximum central intensity of .91 x continuum. The line characteristics such as red and violet peak intensities and positions, center shifts and wing intensities were tabulated. Synthetic H-alpha profiles were generated from a finite layer assuming simple parameteric forms for the source function and velocity field. The velocity chosen always decreased with optical depth and had the same sign. For absorption profiles, bisector shifts were calculated for a variety of velocities. The velocity field and source function were derived as a function of optical depth and time. Author

N77-26055*# Stanford Univ., Calif.
THE MEAN MAGNETIC FIELD OF THE SUN: OBSERVATIONS AT STANFORD
Philip H. Scherrer, John M. Wilcox, Leif Svalgaard, Thomas L. Duvall, Jr., Phil H. Dittmer, and Eric K. Gustafson Apr. 1977 21 p refs Submitted for publication
(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grants NSF ATM-74-19007; NSF DES-75-15664)
(NASA-CR-153255; SU-IPR-682) Avail: NTIS HC A02/MF A01 CSCL 03B

A solar telescope was built at Stanford University to study the organization and evolution of large-scale solar magnetic fields and velocities. The observations are made using a Babcock-type magnetograph which is connected to a 22.9 m vertical Littrow spectrograph. Sun-as-a-star integrated light measurements of the mean solar magnetic field were made daily since May 1975. The typical mean field magnitude is about 0.15 gauss with typical measurement error less than 0.05 gauss. The mean field polarity pattern is essentially identical to the interplanetary magnetic field sector structure (seen near the earth with a 4 day lag). The differences in the observed structures can be understood in terms of a warped current sheet model. Author

N77-26056*# Stanford Univ., Calif. Inst. for Plasma Research.
LARGE-SCALE PERIODIC SOLAR VELOCITIES: AN OBSERVATIONAL STUDY
Phil Howard Dittmer Mar. 1977 211 p refs
(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grants NSF ATM-74-19007; NSF DES-75-15664)
(NASA-CR-153256; SU-IPR-686) Avail: NTIS HC A10/MF A01 CSCL 03B

Observations of large-scale solar velocities were made using the mean field telescope and Babcock magnetograph of the Stanford Solar Observatory. Observations were made in the magnetically insensitive ion line at 5124 A, with light from the center (limb) of the disk right (left) circularly polarized, so that the magnetograph measures the difference in wavelength between center and limb. Computer calculations are made of the wavelength difference produced by global pulsations for spherical harmonics up to second order and of the signal produced by displacing the solar image relative to polarizing optics or diffraction grating. Author

N77-26057# Academy of Sciences (USSR), Moscow. Space Research Inst.
ION FLUX PARAMETERS IN THE SOLAR WIND-VENUS INTERACTION REGIONS ACCORDING TO VENERA 9 AND VENERA 10 DATA
O. L. Vaisberg, S. A. Romanov, V. N. Smirnov, I. P. Karpinsky, B. I. Khazanov, B. V. Polenov, A. V. Bogdanov, and V. M. Antonov 1976 21 p refs Presented at the Intern. Symp. on Solar-Terrest. Phys., Boulder, Colo., Jun. 1976
(D-232) Avail: NTIS HC A02/MF A01

The measurements of the angular and energy distributions of ion fluxes on board Venera 9 and Venera 10 space probes show several specific regions with different properties of the plasma in the solar wind-Venus interaction region. Some features of the spatial and velocity distributions of the ion fluxes evidence the direct interaction of the solar wind with the planetary atmosphere. The existence of a rarefaction region, the internal flow of ions, and mixing of two components of plasma show the viscous interaction of shocked solar wind with the atmosphere of Venus through the exchange of mass and momentum across the ionopause. Author (ESA)

N77-26058# Naval Electronics Lab. Center, San Diego, Calif.
PARENT-FLARE EMISSION AT 2.8 GHz AS A PREDICTOR OF THE PEAK ABSORPTION OF POLAR-CAP EVENTS Research and Development Report, May 1975 - Jun. 1976
Edward W. Oliver 1 Dec. 1976 24 p refs
(WF52551717)
(AD-A037552; NELC-TR-2015) Avail: NTIS HC A02/MF A01 CSCL 04/1

Parent-flare 2.8-GHz event energy is correlated with peak riometer absorption for 47 Polar-Cap Absorption (PCA) events which occurred during the nineteenth and twentieth solar cycles. Thirty-two of these events had riometer absorption of > or = 2.0 dB. The least-squares relationship between the peak absorption (A) and the burst energy (E) is given by A(dB) = 0.0116 E to the 0.5555 power with a coefficient correlation, R, of 0.59, where E is given in sfu-min. The peak absorption predicted by this formula is within a factor of 2 of that actually observed for 22 of the 32 principal PCA events (69 percent) and within a factor of 3 for 28 of the 32 events (88 percent). A correlation for the effect of the interplanetary magnetic field on particle propagation is considered in the appendix. Author (GRA)

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-26059*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER SIMULATION OF THE VELOCITY DIFFUSION OF COSMIC RAYS
Thomas B. Kaiser, Thomas J. Birmingham, and Frank C. Jones Mar. 1977 63 p refs Submitted for publication
(NASA-TM-X-71324; X-602-77-67) Avail: NTIS HC A04/MF A01 CSCL 03B

Monte Carlo simulation experiments were performed in order to study the velocity diffusion of charged particles in a static turbulent magnetic field. By following orbits of particles moving in a large ensemble of random magnetic field realizations with suitable chosen statistical properties, a pitch-angle diffusion coefficient is derived. Results are presented for a variety of particle rigidities and rms random field strengths and compared with the predictions of standard quasi-linear theory and the nonlinear partially averaged field theory. Author

N77-26060*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIO AND X-RAY VARIABILITY OF THE NUCLEUS OF CENTAURUS A (NGC 5128)
J. H. Beall (Maryland Univ., College Park), W. K. Rose (Maryland Univ., College Park), W. Graf (Stanford Univ.), K. M. Price (Stanford Univ.), W. A. Dent (Massachusetts Univ., Amherst), R. W. Hobbs, E. K. Conklin (National Astronomy and Ionosphere Center, Arecido, Puerto Rico), B. L. Ulich (National Radio Astronomy Observatory, Tucson, Ariz.), B. R. Dennis, C. J. Crannell et al Apr. 1977 12 p refs Submitted for publication
(Grant NGL-21-002-033)
(NASA-TM-X-71327; X-682-77-93) Avail: NTIS HC A02/MF A01 CSCL 03B

Centaurus A was observed at radio frequencies of 10.7, 31.4, 85.2, and 89 GHz and at X-ray energies greater than 20 keV. The source exhibits significant variability in all the observed radio frequencies. The observed radio and X-ray intensities show some concurrent variations but do not track one another throughout the observations. A model of the source in which X-rays are produced by inverse Compton scattering of blackbody photons by relativistic electrons is proposed to explain these observations. The observed variations in the electromagnetic

spectrum are consistent with adiabatic expansion of a trapped plasma in conjunction with turbulent accelerations of the relativistic electrons. Author

N77-26061*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GAMMA RAYS FROM THE DE-EXCITATION OF C-12 RESONANCE 15.11 MeV AND C-12 RESONANCE 4.44 MeV AS PROBES OF ENERGETIC PARTICLE SPECTRA

Carol Jo Crannell, Hall Crannell (Catholic Univ. of Am.), and Reuven Ramaty May 1977 8 p refs Presented at the 12th ESLAB Symp., Recent Advances in Gamma-Ray Astronomy, Frascati, Italy, 24-27 May 1977

(NASA-TM-X-71331; X-682-77-118) Avail: NTIS HC A02/MF A01 CSCL 03B

The flux of 15.11 MeV gamma rays relative to the flux 4.44 MeV gamma rays was calculated from measured cross sections for excitation of the corresponding states of C-12 and from experimental determinations of the branching ratios for direct de-excitation of these states to the ground state. Because of the difference in threshold energies for excitation of these two levels, the relative intensities in the two lines are particularly sensitive to the spectral distribution of energetic particles which excite the corresponding nuclear levels. For both solar and cosmic emission, the observability of the 15.11 MeV line is expected to be enhanced by low source-background continuum in this energy range. Author

N77-26062*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OBSERVATIONS OF CELESTIAL X-RAY SOURCES ABOVE 20 keV WITH THE HIGH-ENERGY SCINTILLATION SPECTROMETER ON BOARD OSO 8

Carol Jo Crannell, Brian R. Dennis, Joseph H. Dolan, Kenneth J. Frost, Larry E. Orwig, James H. Beall (Md. Univ., College Park), and Gregory S. Maurer (Catholic Univ. of Am.) May 1977 11 p refs Presented at the 12th ESLAB Symp., Recent Advances in Gamma-Ray Astronomy, Frascati, Italy, 24-27 May 1977

(Grant NsG-5066)

(NASA-TM-X-71332; X-682-77-121) Avail: NTIS HC A02/MF A01 CSCL 03B

High-energy X-ray spectra of the Crab Nebula, Cyg- XR-1, and Cen A were determined from observations with the scintillation spectrometer on board the OSO-8 satellite, launched in June, 1975. Each of these sources was observed over two periods of 8 days or more, enabling a search for day-to-day and year to year variations in the spectral and temporal characteristics of the X-ray emission. No variation in the light curve of the Crab pulsar was found from observations which span a 15-day period in March 1976, with demonstrable phase stability. Transitions associated with the binary phase of Cyg XR-1 and a large change in the emission from Con A are reported. Author

N77-26063*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE HIGH ENERGY PROTON SPECTRUM MEASUREMENTS

R. W. Ellsworth (Maryland Univ., College Park), A. Ito (Maryland Univ., College Park), J. MacFall (Maryland Univ., College Park), F. Siohan (Maryland Univ., College Park), R. E. Streitmatter (Maryland Univ., College Park), S. C. Tonwar (Maryland Univ., College Park), P. R. Vishwanath (Maryland Univ., College Park), G. B. Yodh (Maryland Univ., College Park), and V. K. Balasubrahmanyan May 1977 26 p refs Submitted for publication

(NASA-TM-X-71333; X-661-77-127) Avail: NTIS HC A03/MF A01 CSCL 03B

The steepening of the proton spectrum beyond 1000 GeV and the rise in inelastic cross sections between 20 and 600 GeV observed by the PROTON-1-2-3 satellite experiments were explained by systematic effects of energy dependent albedo (backscatter) from the calorimeter. Author

N77-26064# Academy of Sciences (USSR), Moscow. Space Research Inst.

PROPAGATION OF NONRELATIVISTIC ELECTRONS IN THE INTERPLANETARY SPACE

V. G. Kurt, E. V. Mishin, and N. F. Pissarenko 1976 17 p refs

(D-233) Avail: NTIS HC A02/MF A01

The two-component structure of electron fluxes in the interplanetary space was found by means of the experiment carried out on board the Prognoz satellites. It is shown that observed properties of the nonrelativistic electron propagation may be explained by their interaction with excited plasma oscillations. The estimates of electron beam stabilization due to suppressing of relaxation by induced scattering are performed. It is concluded that the more accurate measurements of the distribution function for electrons with both fast and diffusive components will allow a better knowledge of hot electron propagation in interplanetary space. Author (ESA)

N77-26065# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

PROPOSAL OF AN EXPERIMENT FOR THE MEASUREMENT OF XUV RADIATION IN INTERSTELLAR SPACE BY MEANS OF A ROCKET IN THE EQUATORIAL ZONE [PROPOSTA DI UN ESPERIMENTO PER LA MISURA DELLA RADIAZIONE XUV NELLO SPAZIO INTERSTELLARE MEDIANTE RAZZO NELLA ZONA EQUATORIALE]

C. Bonifazi, G. Marangoni, and F. Paresce, Principal Investigator (Calif. Univ., Berkeley) Sep. 1976 60 p refs In ITALIAN

(LPS-76-24) Avail: NTIS HC A04/MF A01

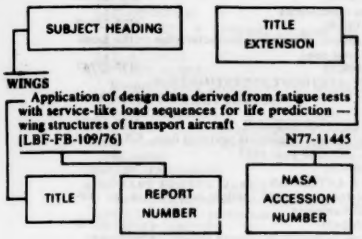
An instrument is described for the measurement of the interstellar electromagnetic field intensity in the region between 1,050 and 500 A. This measurement is justified as a result of the data supplied by the Copernicus satellite as well as those supplied by the Apollo-Soyuz flight. The experiment is based on an XUV spectrometer using a concave mirror with normal reflection having a resolution of 50 A. The best experiment conditions are envisaged upon launch from an equatorial base in Kenya. ESA

99 GENERAL

No abstracts in this category.

SUBJECT INDEX

Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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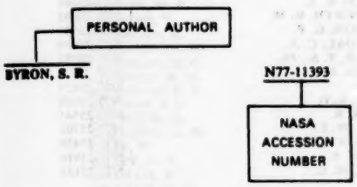

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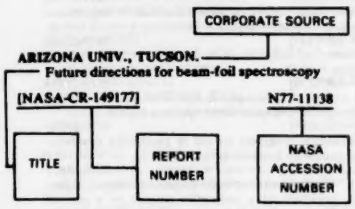

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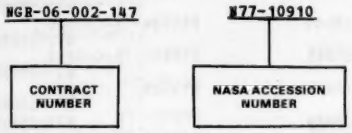

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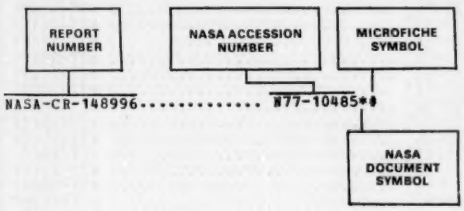

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AEDC-TR-76-172 ..... N77-25242*#
AEDC-TR-77-20 ..... N77-25120 #

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AEROTHERM-TR-76-16(7113) ..... N77-25247 #

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ARO-PWT-TR-76-127 ..... N77-25116 #

ARO-VKF-TR-75-152 ..... N77-25115 #
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ARO-VKF-TR-76-65 ..... N77-25242*#
ARO-VKF-TR-76-66 ..... N77-25114 #

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NADC-76119-40 ..... N77-25798 #
NADC-76297-30 ..... N77-25343 #
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NASA-CASE-GSC-11571-1 ..... N77-25499*

NASA-CASE-KSC-11030-1 ..... N77-25772*

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NASA-CASE-MSC-19546-1 ..... N77-25536*#

NASA-CASE-NPO-13147-1 ..... N77-25502*
NASA-CASE-NPO-13798-1 ..... N77-25535*#
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NASA-CR-2667 ..... N77-25581*#
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NASA-CR-135183 ..... N77-25534*#
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NASA-CR-150278 ..... N77-26013*#
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NASA-TM-X-3517 ..... N77-25249*#
NASA-TM-X-3540 ..... N77-25091*#
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NASA-TM-X-3542 ..... N77-25092*#
NASA-TM-X-3551 ..... N77-25345*#
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NASA-TM-X-71333 ..... N77-26063*#
NASA-TM-X-71334 ..... N77-25711*#
NASA-TM-X-72610 ..... N77-26049*#
NASA-TM-X-73211 ..... N77-25890*#
NASA-TM-X-73238 ..... N77-25088*#
NASA-TM-X-73396 ..... N77-25207*#
NASA-TM-X-74034 ..... N77-25913*#

NASA-TM-75127 ..... N77-25909*#

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NASA-TN-D-8464 ..... N77-25454*#
NASA-TN-D-8466 ..... N77-25963*#
NASA-TN-D-8473 ..... N77-25085*#
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NASA-TN-D-8504 ..... N77-25537*#
NASA-TN-D-8508 ..... N77-25630*#
NASA-TN-D-8511 ..... N77-25219*#

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NASA-TT-F-17310 ..... N77-25981*#
NASA-TT-F-17425 ..... N77-25453*#
NASA-TT-F-17446 ..... N77-25150*#

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NBS-SP-462 ..... N77-25514 #

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NBSIR-75-938 ..... N77-25918 #
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NLR-TR-75090-U ..... N77-25094 #
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NLR-TR-75124-U ..... N77-25098 #
NLR-TR-75129-U ..... N77-25584 #
NLR-TR-75171-U ..... N77-25136 #
NLR-TR-76003-U ..... N77-25874 #
NLR-TR-76018-U ..... N77-25460 #
NLR-TR-76076-U ..... N77-25312 #
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NOAA-77012808 ..... N77-25747 #
NOAA-77020701 ..... N77-25744 #
NOAA-77020702 ..... N77-25746 #
NOAA-77021004 ..... N77-25745 #
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NPS-620L76102 ..... N77-25417 #
NPS-620L76105 ..... N77-25406 #
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NRL-MR-3413 ..... N77-25939 #
NRL-MR-3421 ..... N77-25911 #
NRL-MR-3432 ..... N77-25795 #
NRL-MR-3433 ..... N77-25265 #

NRL-8066 ..... N77-25512 #
NRL-8074 ..... N77-25527 #
NRL-8084 ..... N77-25391 #

NR76H-113 ..... N77-25796 #
NR76H-137 ..... N77-25165 #

NSF-76-310 ..... N77-26006 #
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NSF-76-322 ..... N77-26005 #

NSF/ERG-75-48 ..... N77-25673 #
NSF/IDOE-MANGANESE NODULE-15 ..... N77-25622 #
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NSF/RA-760320 ..... N77-25564 #
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NSF/RA/N-75-338A-VOL-1 ..... N77-25612*#
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NSF/RA/N-75-338C-VOL-3-APP ..... N77-25614*#
NSF/RA/X-74-047 ..... N77-25357 #
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PB-264410/2 ..... N77-25594 #
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